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Founded by L. B. Mackenzie, 1916

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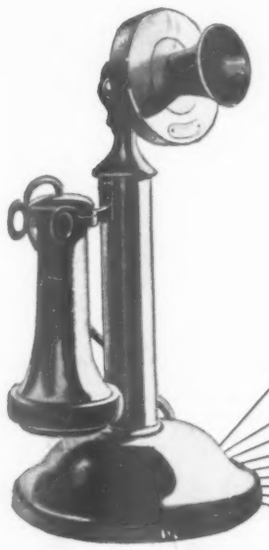

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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EDITORIAL

Associations as Business Builders

SPEAKING before a recent meeting of the American Trade Association Executives, F. M. Feiker, director of the Board of Foreign and Domestic Commerce, has indicated that each trade association should act as an essential unit in the general endeavor to stabilize business conditions and restore confidence in business. He states that the challenge to the trade association at the present time is to organize and plan a program in specialized fields for meeting the economic problems of the moment; such a program depending in a very large degree upon the development of a more complete knowledge of markets and a better knowledge and control of costs. The executives of associations which are doing constructive work and accomplishing real results are probably thinking along the same lines. They would only be too glad to see their own associations so organized and so financed as to be able to provide the machinery whereby the membership would be able to reconcile the factors of production and demand with greater accuracy. The big difficulty lies in convincing individual members of the value of such activity. Mr. Feiker, however, lays it down as a principle that every industry must see to it that it is in possession of factual information concerning both the internal and external trends of that industry which are pertinent to it. He visualizes a new type of trade organization which would function fundamentally as an economic planning unit for its industry and trade. Since all industries are now suffering to some extent through the very lack of this type of activity in the past, present conditions are in themselves a strong argument for this type of association work which might serve as insurance against a recurrence of similar conditions in the near future. The metal working industries contain a great many trade associations. Some of them are still carrying on programs based on conditions that existed when the associations were formed. The demand for a change of program should come from the membership of such groups, and should be supported by the membership. Every trade association today should be active in looking ahead and planning ahead to eliminate guess work, mistakes and blunders in the future operations of its members.

Pipe Line Possibilities

OUTSTANDING among the major pipe line announcements of the past month is the proposal of a second line of 24-inch pipe to bring natural gas from Texas to Chicago, the first 950-mile job having been completed this past summer and setting a world record for natural gas lines. The completion of this job within a twelve-month period was accompanied by the development of many new procedures in surveying, organization, welding, inspection, liaison, installation, and covering. It was an engineering achievement which will in all probability be known in detail to only a few. Those who could write the story are undoubtedly too busy getting ready the plans for the next job, and thinking in terms of improving still further the efficiency of the project. It is an encouraging outlook for those whose products and services will be required. This is true not only with respect to the main line of pipe but also on account of the possibilities for tributary lines. The magnitude of the latter is difficult to estimate. The low cost of delivery from main lines through branches is certain to change the character of some communities, inviting the location of new industries, and improving living conditions, and raising real estate values. In some cases, the development may have an adverse effect on oil burner markets. That is something for the firms to think about who have been careless in their welding of storage tanks for oil burner installations. On the whole, the prospects look good for a great deal of pipe line welding for natural gas in the central states for several years to come. Nor is this the extent of the pipe line picture. Indications are that the successes of the gasoline-carrying lines laid during the past two years have been so great that companies owning them have distinct advantages over competitors. In fact, the transportation cost has been estimated by good authorities to be a dollar per hundred gallons less than tank car transportation cost. None of the objections raised against gasoline pipe lines seem to have materialized, but, on the contrary, they have shown unforeseen advantages in actual operation. Further construction in this field has the aspect of a certainty based on commercial need. It appears self-evident that the natural gas and oil industries are bound to be large consumers of welding materials in the immediate future regardless of the volume of new drilling activities.

The Trend in Steel Welding

IN the welding industry, one is obliged to pay much attention to steel, because of its wide use as a raw material and because of its weldability. It is, therefore, of great interest to note the important position which welding subjects had on the program of the recent meeting of the American Institute of Steel Construction at White Sulphur Springs. The Institute, in its published report, emphasizes the development of new markets which are estimated to call for over ten million tons of steel if properly promoted, forty per cent of which would be for battledeck floors—a welded product. Robt. E. Kinkead, in a discussion of the "weldery" matched this tonnage indirectly by indicating the possibilities for "weldery" production in the state of Ohio alone under this year's demand conditions. P. J. Horgan ably answered the question of engineering acceptance by showing that the welding processes play an important role today as efficient and economical methods of getting results, both costs and results being predictable. And to these papers and discussions was added the visual impression of a motion picture showing the welding of a steel frame house. The thinking machinery of the steel industry is obviously busy, and it is turning out ideas which point toward a rapidly increasing demand for everything which the welding industry can supply in the shape of improvements in equipment, materials, design, procedure, organization, and engineering skill.

The I. A. A. Convention

NOTHING short of the complete report of the proceedings of this month's convention of the International Acetylene Association can do full justice to the educational value of its program. Especially is this true of the evening session on training and testing. In spite of a terrific rainstorm and the fact that the day was a holiday the attendance exceeded the capacity of the meeting room. Training and testing, presented from a new viewpoint, proved to be an attraction of unexpected force. This new viewpoint was the protection of profits through intelligent control of quality. It is the correct point of view for the welder of today and for his employer. Testing does not necessarily have to be based upon suspicion. It is based rather upon the certain knowledge of its benefits to all concerned. As for the subject of training, it is only necessary to turn back a decade in the history of the welding industry to see how the thought has changed. The old theory that welders could not be trained in any school has been abandoned so completely that the entire discussion on this subject today concerns the best methods of arranging the instruction for specific purposes. The interest aroused by discussions of these subjects will certainly result in real benefits to the entire industry.

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Machine Gas Cutting*

Methods and Economies—Effect of Different Flames on Cut Edges —Regulating Labor Cost and Quality—Preheating and Annealing

By L. M. Curtiss†

THIS article deals with methods of machine gas cutting heavy plate and the metallurgical effect upon the metal after it is cut, and further considers certain economies which may be realized. The practices and results described in this article apply only to machine gas cutting.

L. M. Curtiss

Machine gas cutting made its first appearance in England about 1906 and while it was fairly successful at that time its commercial growth was very slow. The trouble encountered in the early stages of its development was due to the lack of range of the machine, inflexibility, and its inability to give good quality cutting in gauges of plate where the demand would be the greatest. The torch problem which required years for solution was not simply a matter of pressures and tip sizes, but also of design, because all passages must be of the proper size and proportion with outlet orifices perfect in mechanical workmanship so that the gases would have an unhampered flow.

It is extremely difficult to picture the tremendous opportunities which this art has offered. Previous to the use of oxygen, heavy plate was practically limited to a two-inch thickness in gauge when it had to be sheared mechanically in straight lines and there was the usual out of flat condition characteristic of all sheared material. Compare with this a twenty to thirty-inch cut which can be made with oxygen today, not only in straight lines, but also in a curved or irregular direction, with the cut edge either vertical or beveled and without the usual shear distortion. This progress in heavy cutting has created in the steel world a demand for heavy material to be used as machine parts or in high-pressure vessels where elevated temperatures must be withstood. Today there are thousands of uses for gas-cut heavy steel plate which can be met in a few hours with the aid of simple templates in place of complicated patterns, thus avoiding days of preparation and insuring reliable shapes cut from rolled steel.

Wage Payment

During the development of gas cutting, the first thought was to "make the cut," especially on extreme thicknesses, and secondly to give the edges a smooth, pleasing appearance. These two things required years of study, for it was necessary to determine the proper machine speed, the correct pressure and volume of oxygen and the proper tip size for each and every gauge cut.

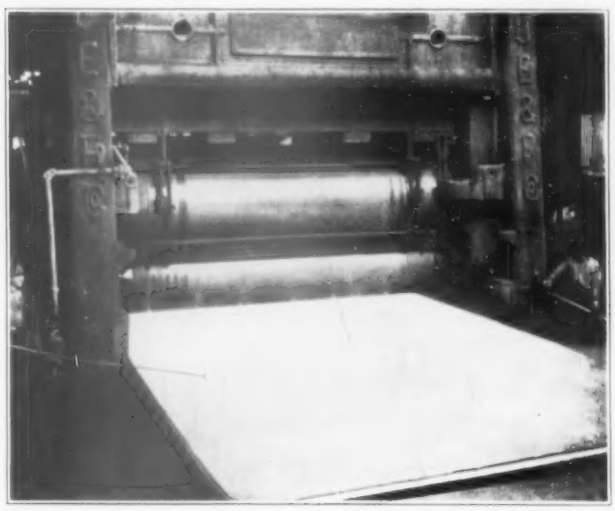
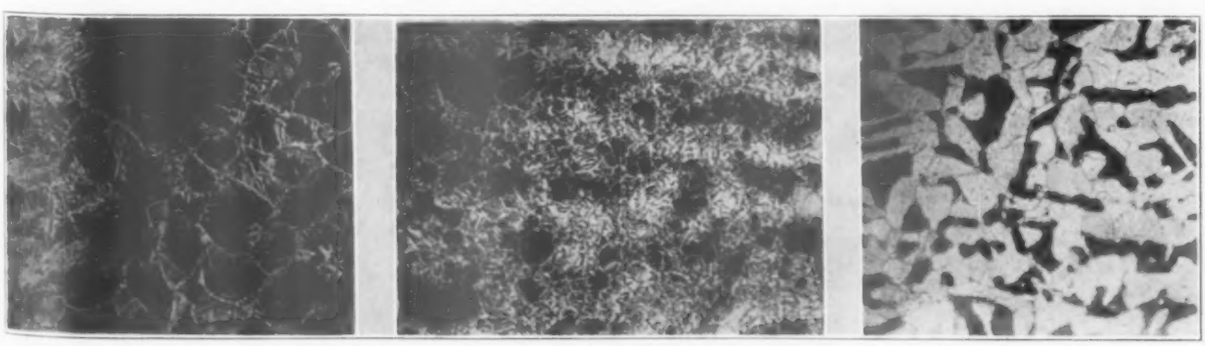


Figure 1. Two Hundred Six-Inch Rolling Mill in the Plant of the Lukens Steel Company

Little thought was given to the actual cost of the operation as the advantage to be derived was so great that it overshadowed the expense of cutting. The cutters were generally paid a straight hourly rate and were given general instructions by the foreman on how the job should be done. An incentive wage payment plan was considered very illogical, as a large plate could easily be spoiled by hurried work and because the labor involved in cutting was not the initial consideration. The cost of oxygen and acetylene consumed in cutting heavy thicknesses is several times the cost of the

*Read before the 32nd annual convention—International Acetylene Association, Chicago, Illinois—November 11, 12, 13, 1931.

†Superintendent, One Hundred Forty and Two Hundred Six-Inch Rolling Mills, Lukens Steel Company, Coatesville, Pa.



Extreme Gas Cut Edge. Sorbitic Structure

Transition Stage Between Sorbite and Pearlite

Unaltered Pearlitic Structure of Original Plate

Figure 2. Photomicrographs of Gas Cut Edge from a Six-Inch Plate

labor involved. There was the danger that an operator, in accomplishing his task in the least possible time, would use excessive oxygen, thus more than counteracting any benefit derived from fast work. The Lukens Steel Company tackled this problem with many misgivings and were many times advised that it could not be solved. After much study, however, a payment plan was devised whereby each man was paid for the exact amount of work accomplished, and in addition, a bonus was paid on the amount of oxygen saved below a set standard; a penalty was also applied for poor workmanship. It is gratifying to say this plan was successful from the beginning and each succeeding month showed an improvement in labor efficiency. The oxygen consumption, instead of climbing as feared, took a downward course, which resulted in remarkable saving. The quality of cutting was in no way impaired and the amount of rejected material, due to carelessness, was materially reduced.

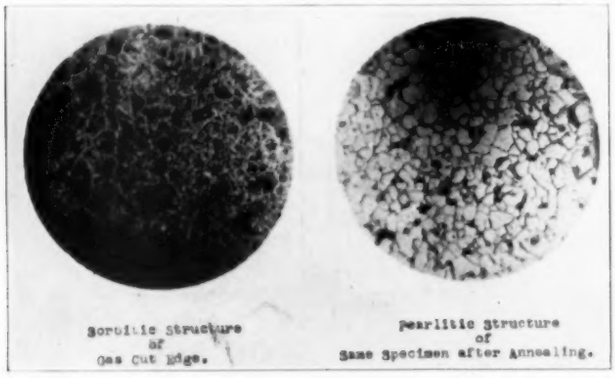


Figure 3. Comparative Photomicrographs of Burned Edge Before and After Annealing

Effect of Cutting

There has been considerable discussion, especially among the users of steel plate, as to the effect of gas cutting on the material cut. When observed microscopically, the cut edge is found to be materially altered as compared with the original metal (Fig. 2). Apparently this is a physical change, as the pearlitic steel has been transformed into an unstable condition, taking one of three forms, sorbitic, troostitic, or martensitic, according to the amount of carbon present in the steel and the speed with which the metal is cooled. This physical change is due to the metal adjacent to the cut being heated considerably above its critical range and cooling quickly through this range. The drop in temperature is caused by heat conductivity of the cold surrounding metal, by radiation losses and by the fact that the heat is only applied momentarily at any one point, the machine being in constant motion while cutting. Another interesting change is the tremendous grain growth which occurs on the gas cut edge, the grain size gradually tapering back to the normal size in the original metal. Ordinarily, grain growth is caused by holding a piece of steel at an elevated temperature for a prolonged period of time; both temperature and time being functions of its progress. The development of the grains in this case, is due principally to the intensity of the heat, as the time element is very short.

Photomicrograph of Gas Cut Edge From a 6-in. Plate

Extreme gas cut edge. (Sorbitic Structure)	Transition stage between Sorbite and Pearlite	Unaltered Pearlitic Structure of Original Plate

The change in this altered area had previously been considered as merely a physical without any chemical alteration, but it has now been discovered that the carbon content is increased on the burned edges. When the specimen is annealed, however, this carbon difference is equalized. Carbon analyses were made from layers 1/32 of an inch thick, planed from the gas cut edges of various plates with results shown in Table I and Table II. Analysis No. 1 represents the outside layer, No. 2 the second layer, etc.

TABLE I.

Showing Carbon Analyses of Burned Edges (Before Annealing)

	Plate A	Plate B	Plate C	Plate D
No. 1	.32	.27	.16	.12
No. 2	.17	.27	.12	.12
No. 3	.17	.23	.09	.11
No. 4	.10	.22	.10	.10

TABLE II.

Showing Carbon Analyses of the Burned Edges of the Same Specimens (After the Specimens Were Annealed)

	Plate A	Plate B	Plate C	Plate D
No. 1	.19	.21	.08	.10
No. 2	.19	.23	.08	.11
No. 3	.18	.22	.10	.10
No. 4	.17	.23	.11	.10

The next step was to try to find the cause of this carbon increase, the three possibilities being:

(1) Absorption of carbon from acetylene.

(2) Pearlite and Sorbite might give different carbon results under the same method of analysis.

(3) An actual local change due to the physical alteration.

Carbon analyses were taken from several samples, some of

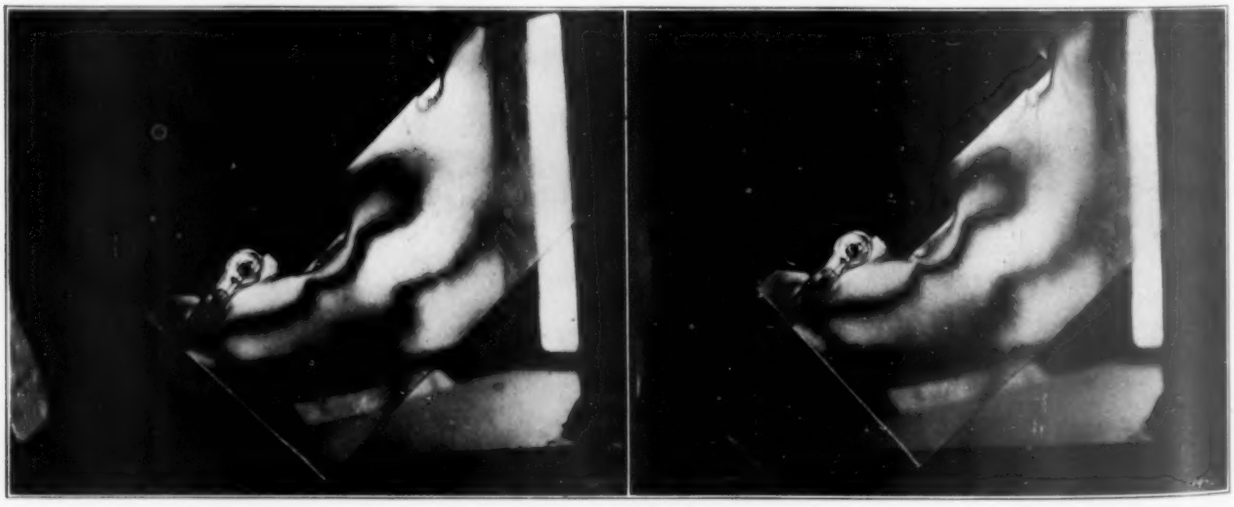


Figure 4. Photo-Elastic Photographs of Celluloid Models of a Housing Plate Under Stress

which were cut with acetylene and some with hydrogen, the idea being to compare the effect of the two fuels and to eliminate if possible the thought of any carbon absorption by the acetylene. The shavings were taken as previously described, each one representing 1/2 of an inch in thickness with results as shown in Table III.

TABLE III.

	Plate E		Plate G		Plate J	
	Acetylene	Hydrogen	A	H	A	H
No. 1.....	.18	.21	.20	.22	.28	.31
No. 2.....	.18	.19	.16	.18	.26	.26
No. 3.....	.17	.16	.16	.15	.24	.24
No. 4.....	.17	.16	.15	.15	.24	.23

The results indicate that any increase in carbon on the outside cut edge cannot be attributed to the carbon in the acetylene, as the hydrogen may also give similar results.

The No. 1 shavings were annealed in order to re-establish the pearlitic condition and were then analyzed for carbon. These checked identically with the original No. 1 samples. This, of course, eliminated the possibility of obtaining a difference in carbon from sorbite and pearlite under the same method of analysis.

The one remaining explanation for the increase in carbon on the outside gas cut edge is that the pearlite patches in the original steel have been absorbed while passing through the transformation range, forming what is known as austenite, or a solid solution. When the cooling action starts, the ferrite is thrown out of the solid solution first, thereby making the remaining solution higher in carbon. In view of the fact that the hottest part of the metal is next to the kerf, the carbon migrates toward this hotter zone, where it is finally concentrated. Sorbite is formed because the metal is cooled so quickly that the pearlite does not have a chance to re-establish itself. This is checked by the fact that whenever a gas cut piece is normalized or annealed the area of increased carbon and altered physical structure disappears completely and the steel returns to its original state. (Fig. 3.)

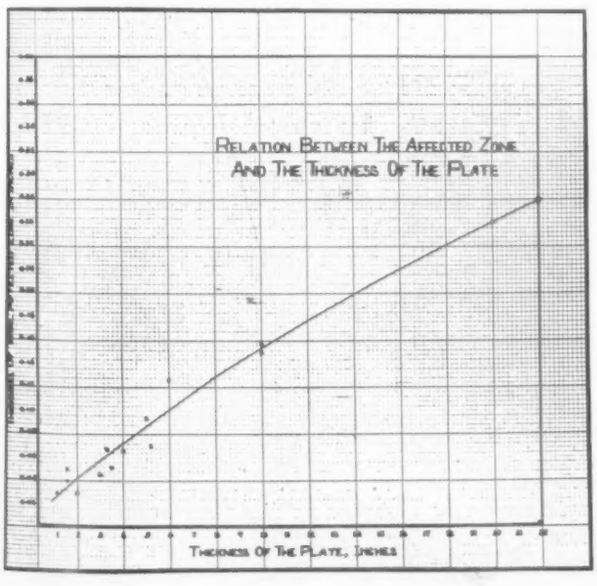


Figure 5

These physical and chemical changes in the steel leave a thin hardened zone on the outside edge, the penetration of which is usually very superficial. With ordinary steels of .30 carbon and under, no particular difficulty is experienced in bending or fabricating, as the sorbitic hardening is not very intense. With high carbon and alloy steels, the precautions of annealing or machining should be used to remove the hardened edge. There are some exceptions, however, in the low carbon steels, which should be recognized. Where a bend occurs with the gas cut edge on the outside surface; or in a machine part where stresses are concentrated at one point and the member is subjected to the fatigue of intermittent tensile stresses. In cases of this kind, all traces of gas cutting should be removed by annealing, planing or grinding. It is extremely necessary to remove any nicks or notches, as they are particularly susceptible to the effect of intermittent stresses,

Figure 6. Remarkably Clean Cut in a Slab Twenty-Two Inches Thick

and form an excellent opportunity for the development of incipient cracks, which in turn may develop into a large fracture.

The photo-elastic photographs in Fig. 4 give an optical picture of concentrated stresses on a celluloid model of a housing plate under stress.

No. 1 shows a dark line with two projections pointing toward the in-cut of the housing plate, and also a smooth, semicircular, lighter line immediately adjacent to the in-cut, which show the effect of stresses and their concentration at the two projecting points.

No. 2 shows the same housing plate, except that the in-cut has been slightly nicked. The dark line is again apparent with the lower projection more sharply defined, and in addition the lighter line, instead of being a smooth curve, is broken and shows a projection pointing directly toward the nick. This indicates that the nick has the effect of concentrating stresses.

The depth of penetration of the altered zone has been found to have a definite relation to the thickness of the material cut. This relationship is shown graphically in Fig. 5.

Preheating the Steel

If the simple precaution is taken of preheating the steel before gas cutting, then the cooling effect will be retarded and this will prevent to some extent the formation of sorbite and reduce the hardness. High carbon and alloy steels, such as chrome vanadium, which are particularly susceptable to temperature changes, should always be preheated and should be annealed immediately after cutting to re-establish the pearlitic condition and to remove all cooling strains.

Hot cutting is not only beneficial to the steel, but is also economical in the use of oxygen. Any steel is more easily oxidized at elevated temperatures than at atmospheric temperature. Special care must be exercised, however, on particularly thick sections where the interior is considerably hotter than the exterior. The oxygen may start its penetration without much difficulty, but upon entering the interior of the section may fail to go through and will cause a flare-up in the cutting. This stoppage is caused by the hot center, which oxidizes so readily that a cavity is formed on the inside of the piece and the flame once being diverted is not easily adjusted. The operator at this point usually makes the wrong move by increasing the pressure which intensifies the trouble and increases the size of the cavity to such an extent that the slab may be ruined. There are some differ-

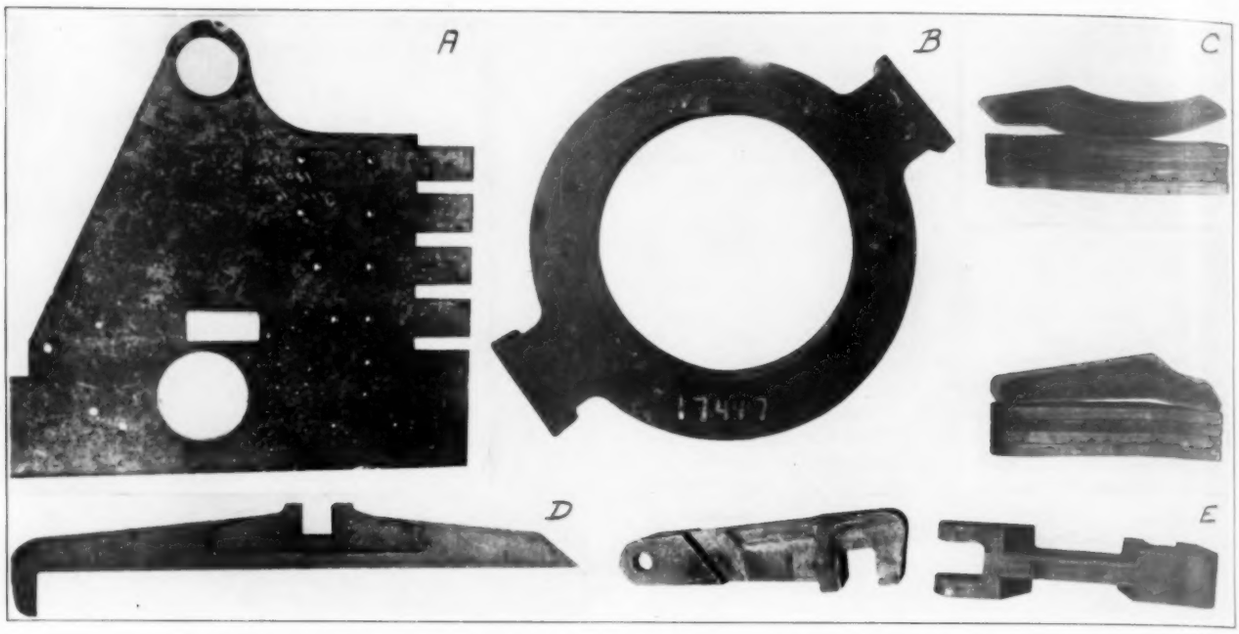


Figure 7. A Widely Diversified Group of Steel Parts Cut to Shape with the Oxy-Acetylene Cutting Machine

A. Housing for a Rock Crusher, Gas Cut from Four-Inch Steel Plate. **B.** Gas Cut Hoisting Yolk for Lifting Hydroelectric Rotor. Overall Dimensions: 5 ft. 6 in. x 4 ft. 3 in. x 7 in. **C.** Equalizer Bars Cut by Camograph. **D.** Billet Gouging Machine Turning Lever Cut from Steel Plate with Reinforcing Plates Welded on Each Side. Length, 6 ft. 6½ in.; width, 16⅞ in.; Thickness, 6 in. **E.** Billet Gouger Operating Arm Cut from Solid Plate which Involves no Welding. It Is 36¼ in. long, 9⅜ in. wide and 9 in. thick.

ences of opinion as to the proper temperature of the steel for the most efficient use of oxygen to obtain the correct penetration, and to leave the steel in the best shape metallurgically. For all practical purposes, 500 to 600 deg. F. should give the best combined result.

Quite a problem is presented in making clean, economical cuts in steel slabs between twenty and thirty inches thick. A generous supply of fuel is needed to support the preheating flame. High oxygen pressure is required to penetrate the entire thickness so that the molten oxide may be blown out of the kerf. If excess pressure is used a large amount of oxygen passes straight through the cut without having any oxidizing action upon the metal and is consequently wasted. In order to compensate for this loss the pressure may be reduced and the volume increased by the use of more than one regulator, and in some cases by using special equipment such as a three-hose torch with large openings and fitted with an extra large hose. Fig. 6 shows a gas cut slab twenty-two inches thick, which presents a remarkably clean surface. Cuts of this thickness are not unusual and a 28 in. gauge has been cut with excellent results.

Mechanical Cutting*

The fact that steel and iron may be satisfactorily cut with the oxy-acetylene torch along a predetermined contour awakened industry to the possibilities suggested by this process.

Metal working industries, searching for new and dependable methods which were applicable to their production schemes found the fabrication idea sound in principle.

Fabrication is based on mechanical or machine cutting with the torch and provides a wide and rapidly broadening field for the latter process in industry.

Companies employing the process include the largest in their respective fields. They have the resources, engineering staffs, laboratories and sales organizations needed to assure successful introduction of products embodying new engineering principles. Such sponsorship assures the sound development and future progress of the mechanical cutting and fabricating processes.

In certain industries, the importance of mechanical cutting, as it is woven into the general production scheme, has justified the develoment of cutting machines possessing increased speed and efficiency. The latest developments along this line comprise cutting machines with multiple torch operation, centrally controlled from the operator's station. This control includes automatic lighting of the torches.

Heavy machine parts and especially those of a special nature are being fabricated in increasing quantities of cut costs. In some cases, the entire job is completed for less than the pattern investment formerly required and in less that the time needed to make the pattern, thus speeding up production.

Parts that are ordinarily punch-press jobs, of a size and thickness of material requiring a high investment in dies, but not being produced on a large scale, are mechanically cut economically. Due to its flexibility of application, one cutting machine serves a multiplicity of purposes.

Some of the advantages of fabricated plate parts over casting, which have contributed to the rapid development of the former are:

1. Blowhole hazard is eliminated.
2. Internal strains, due to pouring, are not present.
3. Full advantage is take nof superior physical properties and uniformity of hot-rolled steel.
4. Better local distribution of material is obtained.
5. Where desired homogeneous products of dissimilar metals may be fabricated.
6. Reduction in weight without sacrifice in strength is obtained. This amounts to 10 to 15 per cent over steel castings and 25 to 50 per cent over gray iron castings.
7. Machining is reduced, since allowances for this are less.
3. Full advantage is taken of superior physical properties
9. Smaller investment is required for equivalent foundry tonnage.
10. A 100 per cent saleable product is assured.

Smaller companies are watching the developments in mechanical cutting and fabricating very closely and many are expected to borrow from the experience of the leaders who have blazed the trail and enter the field on their own account in the near future. The march of progress in the metal working industries, coupled with present economic conditions have resulted in marked increases in mechanical cutting applications during the past year.

*From the 1931 *Report of the Oxy-Acetylene Committee of the International Acetylene Association.*

Resistance Welding the 18-8 Steels

Failures Are Traceable to Incorrect Technique and Can Usually Be Corrected by Use of Equipment Having Automatic Control of Heat, Time and Pressure

By Malcom Clark†

MANY rapid developments have been made in the last few years in corrosion resisting steel by practically every steel company in the country having electric furnace capacity, and the wide and diversified uses to which this alloy steel is being put by manufacturers of products requiring corrosion and heat resisting steels has brought the subject of welding stainless steel by the resistance method very much to the front at the present time. While the field for the use of stainless steel has already expanded to bounds where it would be impossible to mention all the different products being made from it, yet it might be of general interest to mention a few of the products being assembled from stainless steel by the resistance welding method. There are:

Automobile Radiator Shells — Automobile Lamp Rims
Cowl and Running Board Mouldings — Bumpers
Wheel Rims and Spokes
Building Window Casements and Frames
Door Frames — Exterior Trim
Aeroplane Exhaust Pipes — Cafeteria Equipment
Dairy Equipment — Kitchen Sinks

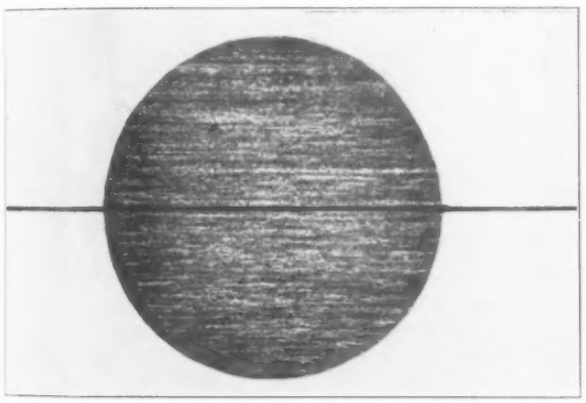


Fig. 1. Properly Made Flash Weld in Stainless Steel.

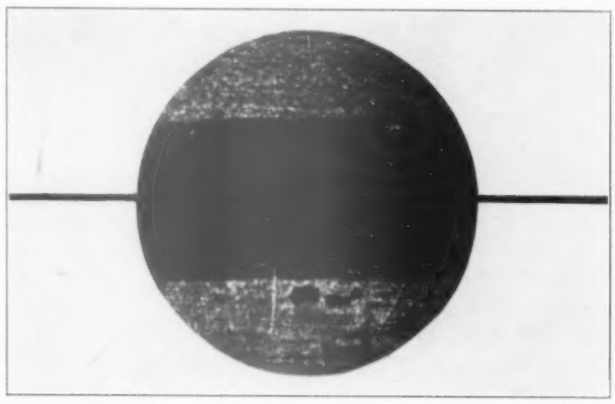


Fig. 2. Weld Made in Same Stock as That Shown in Fig. 1, But Does Not Resist Corrosion So Well Because of Faulty Procedure.

and many other important items will, no doubt, be added to this list as the use of stainless steel develops and a better knowledge of assembling different products by the resistance welding method is obtained, as it has been well stated that welding is one of the world's best, quickest and cheapest assembly methods.

Before going into the welding characteristics and the proper welding procedure, it might be well to get a proper understanding of the characteristics of the steel to be welded:

The straight chromium type of corrosion resisting steel, which has a chromium content of twelve to eighteen percent, presents a somewhat greater problem to resistance welding than does the more popular type of stainless steel, known as the eighteen and eight type, signifying a composition of around eighteen percent chromium and eight percent nickel. This straight chromium type of stainless steel is more difficult to weld due to the fact that there is considerable tendency toward grain growth, leaving the weld very brittle. With the proper welding equipment and set-up, however, very satisfactory welds can be made, and in fact are being produced in greater quantities at the present time.

†Chief Engineer, The Taylor-Winfield Corp., Warren, Ohio.

Since the eighteen and eight type of stainless steel is the most popular, we will consider this type from a welding point of view. This steel itself is very tough but with no capacity for hardening with heat treatment; the difficulties of grain growth and brittle welds, therefore, are eliminated. In the resistance welding of the eighteen and eight alloy much success has been obtained, in fact, it can safely be said that any product now made from ordinary steel by the welding method, either resistance butt welding or spot welding, may be changed to stainless steel and still be assembled by welding. Many large users of the eighteen and eight alloy of stainless steel are successfully resistance welding a great variety of products.

On the other hand, however, there have been some manufacturers who have attempted to resistance weld certain products from stainless steel without meeting with the desired results. Their failure, of course, can be attributed to either one, or both, of two things:

The first important factor causing failure in welding stainless steel is the lack of the proper understanding of the characteristics of the alloy and the correct welding procedure; and the other factor is the use of improper equipment. It cannot be expected that satisfactory welds will be made in stainless steel on a worn out, obsolete design, resistance welding machine.

It might be well to point out some of the characteristics of the alloy insofar as they affect resistance welding:

By reference to Figure 1 and Figure 2, a contrast will be noted between a perfect weld and one that is imperfect. Figure 1 shows a magnified photograph of the surface of a stainless steel strip which has been resistance butt welded. After the welding flash was removed, the sample was exposed to hot nitric acid, without the slightest indication of corrosion. Figure 2 also shows a magnified photograph of a sample of stainless steel taken from the same strip as was the sample for Figure 1, and welded on the same capacity machine under different conditions. After the welding flash was removed from sample No. 2, it also was exposed to hot nitric acid, and it will be observed in Figure 2 that there is an area on each side of the weld, paralleling the weld line, which is badly corroded. This, of course, is the result of the hot nitric acid attacking the stainless steel at this particular area on each side of the weld line, but not on the weld proper.

The condition shown in Figure 2 is neither caused by the actual welding, nor by the heating of the material, but rather by the slow cooling of the steel within the area where the corrosion occurred, inasmuch as slow cooling of this type of stainless steel within the critical temperature range of 1400 to 1000 degrees Fahrenheit causes the carbon content to precipitate as carbides in the crystal planes and grain boundaries, thereby decreasing the resistance to corrosion. Since this condition took place in sample No. 2 in a local area only on each side of the weld, it was susceptible to attack by the acid and corrosion was the result.

The difference in welding procedure for the two different samples was as follows:

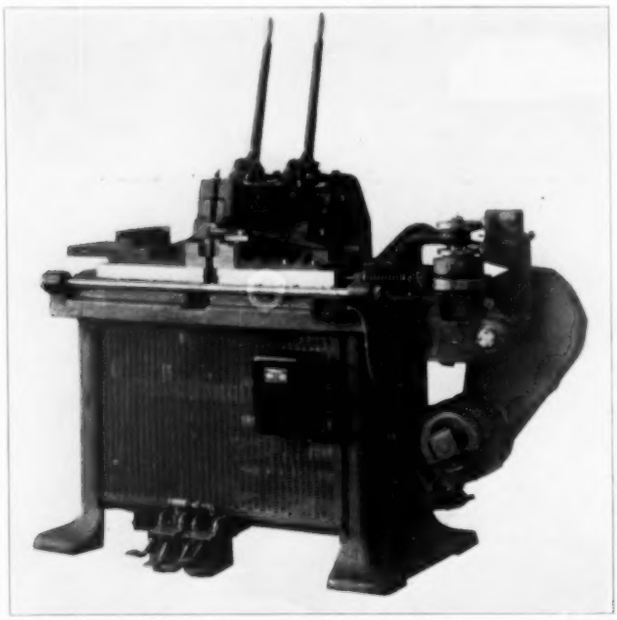


Fig. 3. Automatic Welder Adapted to Work on Stainless Steel.

Sample No. 1, which resulted in a perfect weld, was made on a motor driven, automatically operated resistance flash welder of the type shown in Figure 3. The welding or clamping dies were faced with Elkonite and made to fit the work perfectly with uniform contact. A clamping pressure of approximately 3000 pounds per square inch of die contact was applied on the work, and the automatic machine speeded up, so that the complete welding cycle was only 1¼ seconds.

The advantages of the above welding procedure were that by using Elkonite faced dies it was possible to maintain a perfect contact on the work on account of the harder surface, also the dies would stand up under the heavy clamping pressure. Then with the heavy and uniform pressure on the dies, the heat line at the weld was uniform and did not run back toward the dies in places. Next, by speeding up the welding cycle to 1¼ seconds, the heat was applied only in a very narrow local line where the flashing took place. After the weld was completed the heat was drawn from the weld very rapidly by the welding dies, eliminating the evil of slow cooling within the critical temperature range of 1400 to 1000 degrees Fahrenheit, and the result was a perfect weld.

Sample No. 2 was welded on an ordinary hand operated butt welder, the same as might be used for welding cold rolled stock. Copper welding dies with an average fit to the work were used. The operator made the weld in about four seconds, and while the weld looked good enough when first made, yet when it was exposed to hot nitric acid an area on each side of the weld showed serious corrosion. In analyzing the weld of sample No. 2, it will be noted that on account of the long duration of time for which the heat was applied, the heat ran back through the work toward the dies on each side of the weld line, and then cooled slowly within the critical temperature range of from 1400 to 1000 degrees Fahrenheit.

It is possible to put the carbides back into solution by heat treatment. If, for example, the sample shown in Figure 2 had been heated immediately after welding, to a temperature of 1900 to 2200 degrees Fahrenheit, and then quickly cooled, it would not have been attacked by the acid.

From the foregoing, it will be noted that an important factor in welding stainless steel is high speed, and, in addition, a higher secondary voltage must be used. It is also very important that a good machine be employed, because nearly all products made from stainless steel use light gauge stock. In order, therefore, to get a proper line-up of the work and do it at the high speed necessary, the machine should be of the most modern type. The butt welder shown has long slide ways lined with hardened and ground steel wear plates, thus allowing the slides to be fitted to very close limits and giving perfect alignment. Heavy die-rods re-inforce the frame so that no deflection occurs at the weld. The welding cycle should be controlled automatically with a motor-driven unit in order

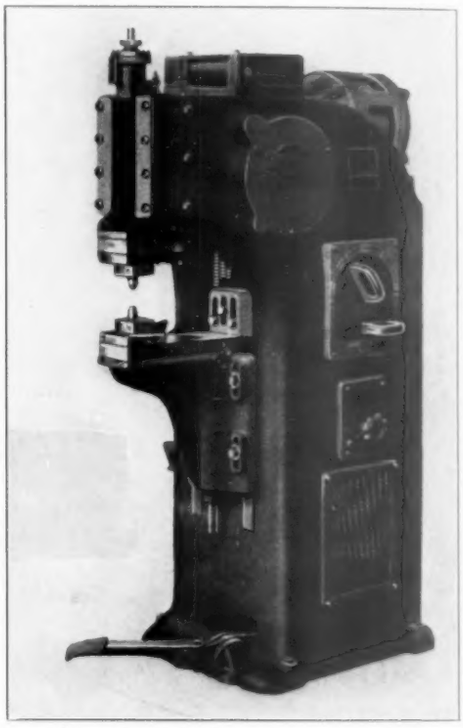


Fig. 4. High Speed Spot Welder for Stainless Steel.

that all welds made will be uniform. Very often manufacturers try to weld stainless steel on obsolete and worn out machines, and, ending in failure, say that stainless steel cannot be welded successfully, where, as a matter of fact, the equipment is at fault.

Then there is the other important item to keep in mind when welding stainless steel, and that is the current-carrying dies or clamping jaws should be made to fit the work perfectly for the entire length of the weld, applying, in addition, plenty of clamping pressure. This will keep the heat from running back from the weld line. On many jobs where copper has been found too soft and requiring fitting too often, this condition has been remedied by using Elkonite facings on the dies. As Elkonite is a very hard material, the dies will often last twenty-five to fifty times longer than those made from hard-drawn copper.

What is true of butt welding stainless steel also applies to spot welding it. An up-to-date high speed machine of the type shown in Figure 4 can be set up to spot weld successfully any type of stainless steel.

Gas Welding Progresses in 1931

Significant Advances Reported at International Acetylene Association — Night Session Draws Record Crowd—Morehead Medal Awarded to A. Cressey Morrison

MUCH credit is due to the program committee of the International Acetylene Association for arranging a series of meetings covering a three day period in such a way as to allow no time for worrying about present business conditions. The meeting was held at the Congress Hotel, Chicago, November 11, 12, and 13. At the opening session President W. D. Flannery, after a brief opening address, introduced Rufus C. Dawes, President of Century of Progress, who delivered a pleasing address of welcome in which he included some up-to-date facts regarding the Century of Progress which is scheduled to open in Chicago June 1, 1933, and invited the attendance and active participation of all members of the industry in that great international event. The keynote address by Bernard J. Mullaney, vice president of the Peoples Gas Light & Coke Company, Chicago, presented the business prospects for 1932 in terms of opportunity for accomplishing improvements in industry. It was an inspiring and stimulating message. The balance of the afternoon session was devoted to a consideration of the future possibilities of welding and of the significant developments in the industry which had taken place during the past year.

Wm. C. Keeley, Jr.,
President of International Acetylene Association for 1931-1932.

On the evening of November 11, there was presented a program of such importance that it was arranged as an evening meeting in order to make it available to a great many men in the Chicago district who otherwise would not have been able to attend because they could not leave their work. The title of the meeting was "Welds, Weld Tests, and The Welder". The program featured the opportunity to make welding more profitable by training men more thoroughly and by controlling the quality of welds with various types of tests. The first part of the evening program consisted of papers on the subject of training and testing. The second part was a spectacular demonstration and explanation of testing methods as follows:

1. Visual Tests—This was in the nature of an introduction to the demonstration. It covered discussions of appearance of welds in steel plate. The purpose was to show how to determine obvious defects in welds by visual examination including lack of penetration, improper condition of weld metal, etc. The demonstration made it clear that appearance is not necessarily a criterion of strength.

2. Hammer and Anvil Test—The demonstration of the nick-break test indicated its importance as a requirement under certain conditions of the revised A. S. M. E. Code.

3. Bend Test—This covered the possibility of securing both qualitative and quantitative ductility values.

4. Tension Tests—This demonstration included the showing of the proper methods of preparing tensile test specimens and showed the significance of the quantitative values obtained from these specimens when they were tested to destruction.

5. Hardness Test—Various hardness testing methods were used to determine the relative hardness of mild steel and of several kinds of alloys used for hard facing.

6. Specific Gravity Test — The method of making this test was demonstrated and an explanation was given to show why this test is included in some portions of the A. S. M. E. Boiler Code.

7. Stethoscopic Test—The use of the Stethoscope to inspect welded structures and locate defective portions of welded joints was explained and the method of operation was demonstrated on a number of specimens.

8. Invisible Ray Test—This demonstration included both X-Rays and Gamma Rays. It was necessarily handled by means of lantern slides showing determinations which had been made from films exposed to both types of invisible rays.

9. Compression Test on Tubing and Drift Test—This demonstration brought out some testing possibilities of unusual interest and of possible great future value because of the constantly increasing use of welded tubing.

10. Hydrostatic Internal Test—In this demonstration a hydraulic pump was used to break welded containers.

Another feature of the meeting was a coupon estimating contest. Three specimens of good welds were furnished with reinforcements cut off. These were mounted on a display card to be estimated for ultimate strength by those attending the meeting. When the test demonstrations were finished, a tensile testing machine was used to break the three specimens. The results were marked up on a blackboard and averaged, and prizes awarded to those who made the closest estimates.

It is estimated that about 1000 attended this interesting meeting, this being so far as is known a record attendance for any meeting ever held in the city of Chicago on the subject of gas welding.

The Thursday and Friday sessions were grouped around the key subjects of transportation, pipe welding in the chemical industry and welding education. The details of these sessions are given in the program of papers which is reproduced above.

The business session of Friday afternoon centered around committee reports and the election of officers. Outstanding among the activities of the business session was the awarding of the Morehead medal.

The Morehead Medal was established in 1922 by John Motley Morehead in honor of his father, the late James Turner Morehead, who in 1892 sponsored the discovery of the electric furnace method of producing calcium carbide. The International Acetylene Association awards a Morehead Medal annually to the person or persons who in the judgment of its Officers and Board of Directors have done most to advance the industry or the art of producing or utilizing calcium carbide or its derivatives.

This year, the 1930 Medal has been awarded to Mr. A. Cressy Morrison, whose services as Secretary-Treasurer of the International Acetylene Association for the past 25 years have been of incalculable value to the acetylene industry. Mr. Morrison, truly one of the pioneers of this organization and of the acetylene industry, has untiringly devoted a large por-

tion of his life and a major portion of his efforts to administration and leadership in this field. The simultaneous growth of the Association and the industry is in many ways traceable to Mr. Morrison's work.

Since 1922, the Morehead Medal has been awarded to the following:

1922—The heirs of James Turner Morehead, deceased, for his original work in producing calcium carbide and ferro-alloys in the electric arc furnace, which he perfected.

1923—Noah Esron Wagner, for his original work and paper on oxy-acetylene welding as applied to oil-carrying lines and pumping stations.

1924—Edmond Fouché, for pioneer work in making safe acetylene compressed in cylinders and for the construction of oxy-acetylene torches.

1925—Augustine Davis, for pioneer work in developing low- and medium-pressure acetylene generators and for advancing the art of oxy-acetylene welding.

1926—Underwriters' Laboratories, for standardizing and safeguarding acetylene equipment.

Program of International Acetylene Association

Thirty-Second Annual Convention

Chicago, Nov. 11, 12, 13, 1931

Wednesday—2: P. M.

WELDING AND INDUSTRY IN 1932

President's Opening Address
W. D. FLANNERY
Harris Calorific Sales Co., New York

Address of Welcome
RUFUS C. DAWES
President, "A CENTURY OF PROGRESS," Chicago

Keynote Address
"Business Prospects for 1932"
BERNARD J. MULLANEY
Vice-President
The Peoples Gas Light & Coke Company, Chicago

Welding and Its Future
PROFESSOR COMFORT A. ADAMS
Lawrence Professor of Engineering
Harvard University
Director
American Bureau of Welding, New York

Phases of Gas Welding
G. O. CARTER
Consulting Engineer
The Linde Air Products Company, New York

Wednesday—8:15 P. M.

WELDS, WELD TESTS, AND THE WELDER

Featuring 1932 profit opportunities for managers and welding-trained men through supervised training and testing
Chairman: E. A. DOYLE
President, American Welding Society, New York

Today's Opportunities for Welding-trained Men in the Metal Working Trades and Industries
DR. S. LEWIS LAND
Educational Director
Heating and Piping Contractors' National Association New York

Training of Welders
THOMAS M. JONES
Superintendent of Welding
Illinois Steel Company, South Chicago, Illinois

Growing Importance of Tests and What They Mean to the Welders and the Welding Industry
(An Introduction to the Following Dramatized Tests)
PROFESSOR H. L. WHITTEMORE
Bureau of Standards, Washington, D. C.

Demonstration and Explanation of the Following Tests:

(1) Visual Inspections
(2) Hammer and Anvil Nick-Break Test
(3) Bending Test
(4) Tension Test
(5) Hardness Test
(6) Specific Gravity Test
(7) Stethoscopic Test
(8) Invisible Ray Test
(9) Compression and Drift Test
(10) Hydrostatic Internal Pressure Test

JOHN J. CROWE
Air Reduction Laboratories, Inc., New York
DR. A. B. KINZEL and W. B. MILLER
Engineers
Union Carbide and Carbon Research Laboratories, Inc., New York

Thursday—10:00 A. M.

TRANSPORTATION

AIR, RAIL, AND MOTOR VEHICLE

Welding on the U. S. Airship Akron
(*Illustrated with Motion Pictures*)
IRVING B. HEXTER
Cleveland, Ohio

Scrapping Railroad Cars by the Production Line Method
T. M. HAMER
Engineer
Air Reduction Sales Company, New York

Present Practices in Rail Bonding
PLINY P. PIPES
Engineer, Ohio Brass Company, Mansfield, Ohio

Gas Welding on the Nickel Plate Road
J. C. MILLER
Superintendent of Shops
New York, Chicago and St. Louis Railroad, Cleveland

The Application of the Oxy-Acetylene Process in the Production of Motor Cars
R. E. ESCH
Plant Engineer
Graham Paige Motors Corporation
Wayne, Michigan

Discussion, led by
F. C. HASSE
Oxweld Railroad Service Company, Chicago

Thursday—2:00 P. M.

WELDED PIPING

PRODUCTION, BUILDING, AND OVERLAND PIPING

Recent Developments in Pipe and Pipe Fittings for Welded Construction
S. HIRSCHBERG
Technician, Products Engineering Department
Crane Company, Chicago

Specifications for Welded Piping for High Pressure and High Temperature Steam Service
F. W. MARTIN
Sargent & Lundy, Chicago

Some Causes of Increased Sales in Welded Piping
A. L. BYFIELD
Himelblau, Agazim & Co., Chicago

Welding in the Heating, Piping, and Air Conditioning Industry
L. B. SPAFFORD
Engineering Editor
HEATING, PIPING, AND AIR CONDITIONING, Chicago

Recent Developments in Welding Overland Pipe Lines (Illustrated with motion pictures)
H. E. ROCKEFELLER
Development Engineer
The Linde Air Products Company, New York

Discussion, led by
W. H. LUDINGTON
Air Reduction Sales Company, New York

Friday—10:00 A. M.

WELDING IN THE CHEMICAL INDUSTRY

Gas Welding Opportunities under the Revised A.S.M.E. Boiler Code
CHARLES E. GORTON
Chairman
Uniform Boiler Law Society, New York

Some Methods and Effects of Machine Gas Cutting
L. M. CURTISS
Superintendent
Lukens Steel Company, Coatesville, Pa.

Gas Welded and Brazed Joints for High Nickel Alloys
F. G. FLOCKE J. G. SCHOENER, and R. J. MCKAY
Engineers
International Nickel Company, New York

Management of Large Piping Installations
G. E. DETHERIDGE
Construction Superintendent
Carbide and Carbon Chemicals Corp.
South Charleston, W. Va.

Discussion, led by
C. A. MCCUNE
Welding Engineering and Research Corporation
New York

Friday—2:00 P. M.

WELDING EDUCATION

What Engineering Graduates Should Know About Welding
E. LUNN
Consulting Engineer, Chicago

Basic Principles of Education and Training in Industry as They May Be Applied to Welding Instruction in Trade and Vocational Schools
W. H. MAGEE
General Motors Institute of Technology
Flint, Michigan

What the Welding Industry Must Do to Receive Engineering Acceptance More Rapidly
PROFESSOR S. C. HOLLISTER
Purdue University, Lafayette, Indiana

Presentation of the Oxy-Acetylene Report and a Discussion of Its Value and Use in Schools
W. H. LUDINGTON
Air Reduction Sales Company, New York
Chairman, Oxy-Acetylene Committee

Discussion, led by
ROBERT MCA. KEOWN
Chief Engineer
Industrial Commission of Wisconsin
Madison, Wisconsin

Friday—3:45 P. M.

BUSINESS SESSION

Report on Behalf of Secretary-Treasurer; Auditing Committee; Legislative and Insurance Committee; and Technical and Engineering Committee
H. S. SMITH, New York

Report of Consulting Engineer
J. I. BANASH
Chicago

Report of House Lighting Committee
G. E. RICHTER
American Lava Company, Chattanooga, Tenn.

Portable Apparatus and Marine Committee
J. A. O'DONNELL
The Linde Air Products Company, New York

Report of Membership Committee
HENRY BOOTH
Shawinigan Products Corporation, New York

Awarding of the Morehead Medal by
C. A. MCCUNE
Welding Engineering and Research Corporation
New York

Report of Resolutions Committee and Nominating Committee
E. L. DAVIS
Acetylene Stove Mfg. Company, Cleveland, Ohio

ELECTION OF 1932 OFFICERS

1927—Herbert L. Whittemore, for outstanding research relating to industrial application of oxy-acetylene welding.

1928—Samuel Wylie Miller, for pioneer work in the metallurgy and engineering of welding.

1929—John Burlin Johnson, for research in and development of oxy-acetylene welding in the aircraft industry.

1930—A. Cressy Morrison, for eminent leadership and administration in the acetylene industry.

Due to the absence of Mr. Morrison, who is in Europe at the present time, the Morehead Medal was accepted for him by E. L. Davis, of Acetylene Stove Mfg. Co., Cleveland, Ohio.

A. Cressey Morrison, Secretary of International Acetylene Association for Past Twenty-five Years, Awarded Morehead Medal at 1931 Convention.

The following officers and directors for the ensuing year were nominated and elected:

President—W. C. Keeley, Jr., National Carbide Sales Co. New York City.

Vice-president—E. J. Hayden, Linde Air Products Co., New York City.

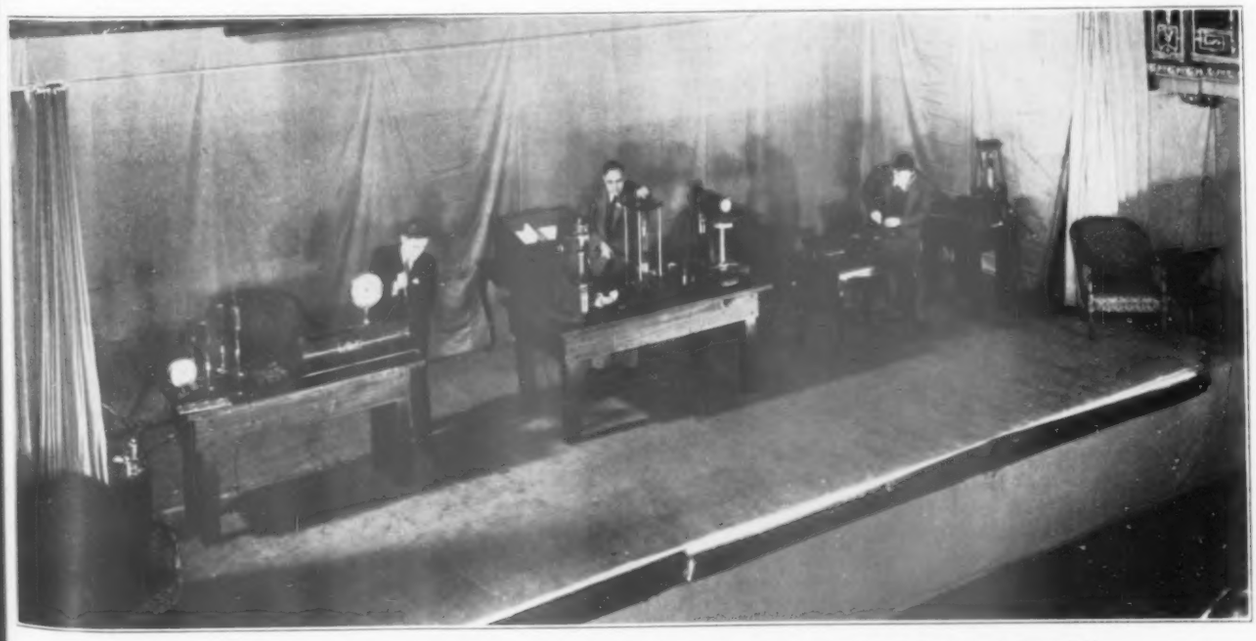
Secretary—H. F. Reinhard, New York City.

Treasurer—W. E. Cotter, New York City.

Directors for three years G. B. Walker, Union Carbide and Carbon Corp., New York; L. F. Loutrel, Shawinigan Products Corporation, New York; W. D. Flannery, Harris Calorific Sales Co., New York.

Wm. C. Keeley, Jr., newly elected president of the International Acetylene Association, was born in Chicago, Ill., and educated in Connecticut, receiving the degree of P.H.P from Sheffield Scientific School, Yale University, in 1916. Subsequent to graduation he was connected with several large industrial firms until 1920 when he joined the Air Reduction Company. He is now assistant vice president of the Air Reduction Company and vice president and general manager of the National Carbide Corporation. Mr. Keeley is a member of several other important engineering societies and has long been an active and enthusiastic participator in association work.

To say that the 1931 convention of the International Acetylene Association broke all previous attendance records does not by any means tell the whole story. Contributions to literature of the industry, represented by the technical papers read at this convention, was of an unusually high order and in addition to this stimulus of the constructive suggestions contained in many of these papers, furnished to the members of meeting. There were over six hundred registrations for the day sessions at which these papers were read, many of whom also attended the night session on testing. The combined registration of day and night sessions was over fourteen hundred, which is more than three times the total attendance of any previous year. A limited number of copies of the papers read are available for distribution, including complete copies of the papers and discussions on testing. There are also available printed copies of the Oxy-Acetylene Committee Report, a valuable document for those interested in these processes. It is also planned to have available within a few weeks bound volumes of the complete proceedings of the 1931 convention.



Demonstrating Various Methods of Weld Testing at Night Session of International Acetylene Association.

W. B. Miller (Left) Tests Coupons on Portable Tensile Test Machine. J. J. Crowe (Center) Is Making Compression Test on Welded Tubing. A. B. Kinzel (Right) Demonstrates Use of Stethoscope on Welds in Steel Plate.

Material Handling in Arc Welding

Work Handling Devices Which Allow Making Fillet Welds in Downward Position Produce a Better Result and a Higher Rate of Deposition

By Robt. E. Kinkead†

THERE appears to be a growing recognition of the fact that when fillet welding is done to meet specified dimensions as determined by gauge, the cost is, in many cases, far higher than was anticipated. The old specification "weld here" on a drawing is giving way to a statement of the fillet size required and the finished job is inspected by gauge. It is the purpose of this article to deal briefly with some improvements in procedure which have been found to effectually reduce the cost of making fillet welds.

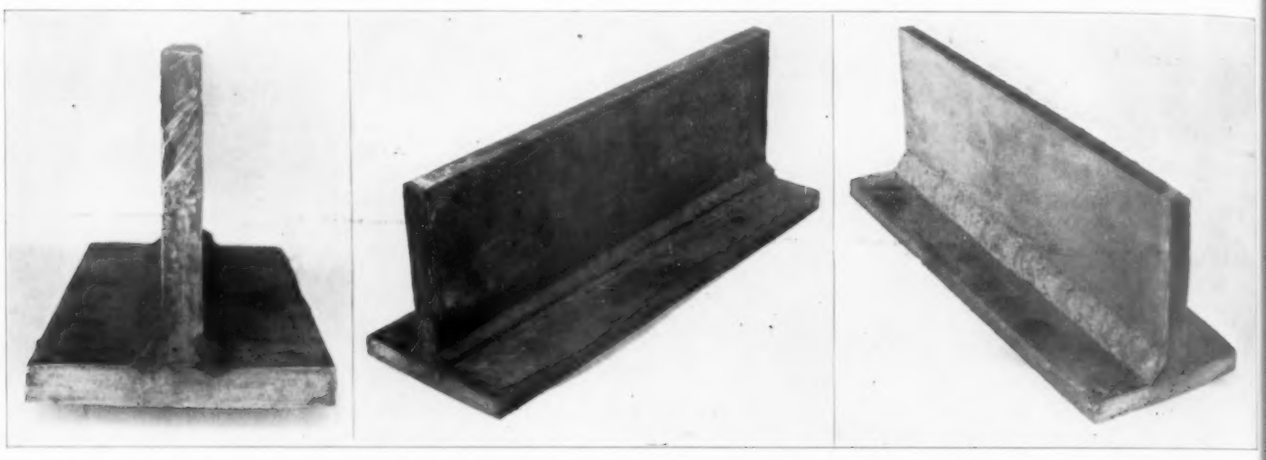


Fig. 1. Showing Improvement in Fillet Weld When Made in Downward Position. Fig. 2 Is a Side View of Fillet Made Sidewise. Fig. 3 Is Side View of Downward Fillet.

For several reasons, bare wire or lime washed welding wire is rapidly being superseded by paste-covered welding rod where it can be applied. The principal reason is that the former costs too much to use. It is true that an operator can weld sidewise or overhead with bare wire, but it is also true that he will only get 1½ to 2 lbs. of metal on the job per hour when he is welding in either position. That means, if he gets paid 65c per hour and the shop overhead is 150 per cent of direct labor, it costs from 80c to $1.10 per pound of metal put on the job. Welding costs too much when it is done in this way, without taking into account the fact that bare wire welding is not good enough for many uses to which welding is being put at the present time.

Table I—Depositation Rates for Paste-Covered Welding Rods

Size Rod Dia. Inches	Lbs. per Foot Pounds	Manual Depositation Rate Operator Welding 35% of the time Pounds per hour	Machine Depositation Rate Operator Working 70% of the time Pounds per hour
1/8	.092	2.6	5.2
1/4	.164	4.6	9.2
5/16	.256	7.2	14.4
3/8	.368	10.3	20.6
7/16	.501	14.0	28.0
1/2	.654	18.3	36.6

Growing use of the so-called "paste" covered welding rods, such as "Fleetweld," G. E. Type R, "Lightning Rod," "Ductone," "Korod," and others, have made it possible to melt welding rods at high rates and get ductile metal in the weld. But these rods are used most advantageously in the downward position—at any rate, high depositation rates may only be obtained in the downward position. Table I is a fair indication of the depositation rates which may be obtained under average conditions with these welding rods. It is evident that the 1½ to 2 pounds per hour obtainable with bare wire is quite out of date—if the high speed rods are applicable to the job.

Figs. 4 and 5. These Pieces Were Placed in Twenty Positions to Make All Welds Downward.

(Continued on page 43)

†Consulting Engineer, Cleveland, Ohio.

Gas Welded Structural Joints*

Details of Tests Made to Demonstrate Safety of Gas Welding to Special Building Code Committee of the City of Detroit

By H. H. Moss†

DURING the period of deliberation of a Special Building Code Committee[1] appointed in 1929 by former Mayor Boles of the city of Detroit to undertake the work of revision, desirable to the Building Code of that city, it befell the Oxy-Acetylene Industry to provide examples of structural gas welding for the observation of and testing by the Special Committee, in order that this process of welding might be given consideration in the welding section of the revised draft, along with other welding processes suitable for the construction of steel for buildings.

This requirement, while on the face being quite singular in view of the promulgation of Code I, Part A, Code for Fusion Welding and Gas Cutting in Building Construction, by the American Welding Society in 1928, lack of local precedent for structural gas welding, warranted, in the opinion of the Committee, a reasonable degree of demonstration.

The requirement of the Special Committee as to character of gas welded examples, as reported by the Consulting Engineer[2] to the Committee, consisted of three structural joints.

One: A typical seat for a beam supported upon the face of a column.

Two: A full strength splice in an average size floor beam.

Three: A side fillet welded tension bar splice to develop the full strength of two joint bars.

It was a further requirement that the specimens be welded by one or more local welders, mechanics who might be utilized on local welded constructions.

These general conditions necessitated the employment of Procedure Control methods, fully applied and at the same time providing an opportunity to demonstrate the practical side of the problem of regulating applied structural gas welding from the standpoint of safety in construction.

It being convenient and agreeable to the interests involved, the writer's company undertook the direct responsibility of developing specimens to meet the requirements of the Committee.

The designs offered to, and subsequently approved by the Committee, are shown on the following Figs. 1, 2 and 3. All welding design for specimens, for both the qualification of welders and for the Committee tests, were made in agreement with the recommendations of the American Welding Society's Structural Welding Code.

The design analysis employed for each and upon which the details of design were determined follows:

For Fig. 1. An assumed safe loading of 12,000 lb. for each seat determined approximately 2 in. in length for the welds securing the seat angle to the face of the columns. A short weld length was desirable in view of the Committee's objective; viz., that of testing weld metal rather than base metal. For the conditions, the unequal angle is preferable. By trial, a 3½ in. x 2½ in. x 7/16 in. angle was found desirable. The conditions of loading for the angle are shown in Fig 4—(a), (b), (c) and (d).

The total length of weld required for direct load = 12,000/3500 = 3.43 in., which, divided by 2, gives 1.72 in. either side of the seat angle. This length must be increased to provide resistance against the forces tending to cause rotation about the weld due to the eccentricities of the applied load with respect to the welds. The tensile stress along the root of the angle acting parallel to the face of the column was considered to be amply provided for by that increment of the fillet weld extending above the upper surface or the landing plane of the angles as shown at T Fig. 4 (a).

Therefore, the welds were investigated, other than for direct shear, for strength to resist the turning force "Wy" Fig. 4 (b).

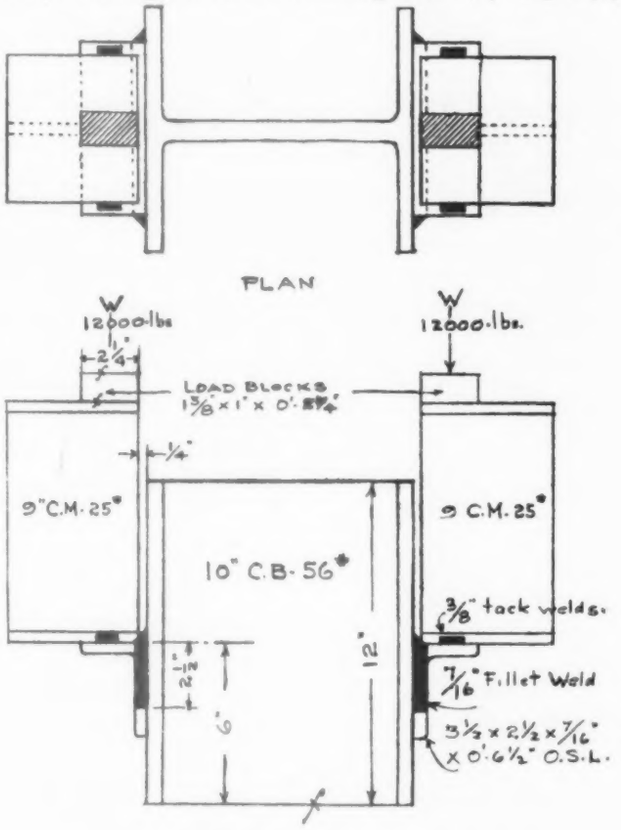


Fig. 1. Beam to Column Connection.

The designed dimension of the throat of these welds below the top surface of the angle is shown in Fig. 4 (d).

The bending moment upon each weld from Fig. 4 (a) and (b) = 12,000 × .575 in./2 = 3450 in. lb., and, therefore the stress at the upper terminals of the weld must be investigated to see that its intensity does not exceed the allowable fiber stress for combined shear and tension which, for the case, was taken at 13,000 lb. /sq. in. The center of rotation was considered to be at ½ the width of the vertical leg as shown in Fig. 4-(d). Therefore, the distance between the assumed center of rotation and the remote fiber intension = 1.75 in. From the foregoing data, the stress p in the weld metal at the top surface of the angle due to the turning force can be found from the formula

$$p = \frac{My}{I_{x\text{-}x}}$$

*Paper presented at the Annual Meeting of the American Welding Society, New York, N. Y., April 1931.

†Engineer, Development Department, Linde Air Products Co., New York City.

[1] Messrs. John M. Donaldson, Chairman; Henry J. Brennen, L. R. Hoffman, J. Gardner Legg, Wm. F. Zabriskie.

[2] Mr. Frank Burton.

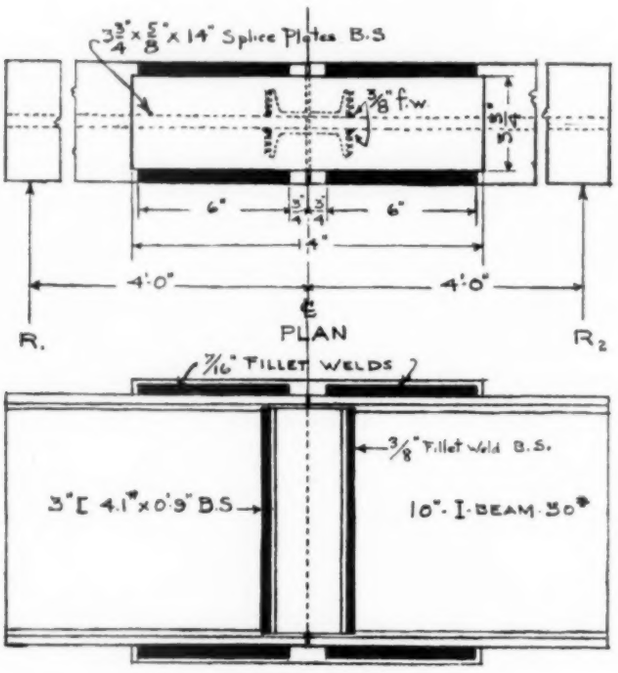
where M = Bending moment in inch pounds
v = Distance in inches of extreme fiber from the assumed neutral axis.
I_{x-x} = Moment of inertia of the throat section of weld about the assumed neutral axis.

Substituting the values derived:

$$p = \frac{3{,}450 \times 1.75}{.595} = 10{,}150 \text{ lb./sq. in.}$$

The average shearing stress per sq. in. upon the throat of the weld = ½ of the load W divided by the designed throat area = 7,775 lb./sq. in.

In determining the resultant stress intensity at the remote fibers of the designed welds, the stress due to bending was considered as a shearing stress of equal intensity acting in the plane of and coincident with the throats of the welds.



ELEVATION

Fig. 2. Beam Splice.

The resultant stress intensity at the remote fiber P_r was then calculated by taking the vector sum of the two intensities:

$$P_r = \sqrt{10{,}150^2 + 7{,}775^2} = 12{,}800 \text{ lb. approximately}$$

which being slightly under 13,000 lb., the welds were considered satisfactory for the loading indicated.

As to the 9 in. C.M. 25 lb. I-Beam, it was found by investigation to have a safe end reaction of approximately 12,350 lb. This value was arrived at by taking 75 per cent[3] of the value resulting from the formula

$$R = F_b \times t \left(a + \frac{d}{4} \right)$$ See Note 4 below

recommended for beams with unsupported webs.

The width of the load blocks used to transmit the load from the upper platen of the testing machine to the beam stubs and likewise the subsequent extension blocks[5] was in agreement with the dimension "x" Fig. 4-(c).

For Fig. 2. For this test, a 10 in., 30 lb. I-Beam (Std. mill section) 9 ft. 6 in. long was cut in two at the center and spliced to redevelop the full strength of the beam.

[3] *Account extreme short length of the beam stubs.*
[4] *Carnegie Handbook.*
[5] *Extension blocks, 2¼ x 1⅝ x 8 in. long, were employed to transmit load to the seat angles after the 9 in. beam stubs had failed by web buckling and were removed from the seats.*

In determining the splice, the stresses due to bending were considered as carried by the flanges. By investigation, the average flange stress was found to be 15,800 lb. per. sq. in. approximately. In calculating for average flange stress, the given flange was, for simplicity, transformed into a rectangle of equal width and equivalent area, whose remote fiber coincided with that of the original flange.

The net flange area neglecting fillets = 2.435 sq. in.

The total stress carried by the flange then = 2.435 × 15,800 = 38,500 lb. and the required area for each splice plate = 38,500/16,667 = 2.31 sq. in.

As the width is determined at 3¾ in. in order to provide space for the fillet welds inside the edges of the flanges, the thickness of the splice plates = 2.31/3.75 = .615 in. A – ⅝ in. plate thickness was adopted.

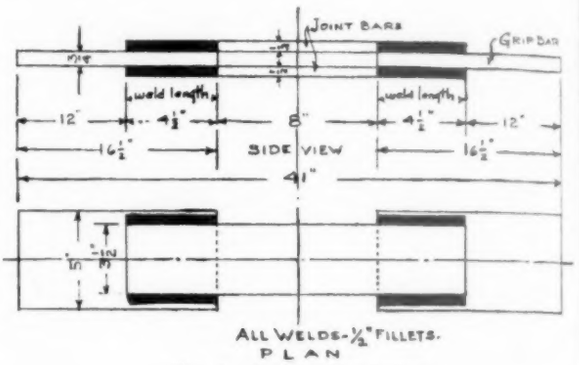


Fig. 3. Tension Bar Splice.

In selecting the size of fillet welds for the specimens, the designed throat demension was taken as the thickness of the edge of the beam flange, which for a 10 in. Std. Mill Section = 0.31 in. This was in order, due to weld reinforcement about the edge of flange customary when welding sections of these dimensions. Therefore, the strength of fillet weld per lineal inch = 0.31 × 11,300 = 3,500 lb. Number of inches of weld required each side of center line of joint = 38,500/3,500 = 11 in. or 5½ in. each side. Six in. was used. About the center of the splice, the welds were kept ¾ in. from the end of beam to prevent possibility of transfer of stress across flanges, instead of through splice bars. Therefore, the length of splice plates required = 2 (6 + .75) = 13.5 in.

Two 3 in. — 4.1 lb. channels were fitted between flanges symmetrically about the center line of joint and welded as shown to prevent failure of the web during the test. The ½ in. welds either side of these channels more than restored the web strength. Two splice plates were used merely to enable setting up the beam under the most favorable conditions as to straightness of top flange. Otherwise some credit for the compressive strength of the original beam section above the neutral axis could have been taken and the top splice in consequence materially reduced in length.

The maximum resisting moment of the beam ($f_b S$) = 16,667 × 26.7 = 445,000 in. lb. Therefore, R_{max} = 445,000/48 in. = 9,275 lb. Therefore, W_{max} = 9,275 × 2 = 18,550 lb. approximately.

For Fig. 3. Strength of joint bars (3½ in. × ½ in. × 1 ft. 5 in.) A = 1.75 sq. in.
Tensile strength at 18,000 lb./sq. in. = 1.75 × 18,000 = 31,500 lb. per bar.

[6] *Fc for a ratio of* $20 \frac{1}{b}$ = 16,667 *lb. per sq. in. when using Fc maximum* = 18,000 *lb. per sq. in. @* $15 \frac{1}{b}$. *Therefore, the unit flange stress at the inside face of the equivalent flange* = $16{,}667 \times \frac{4.49}{5.00}$ = 14,950 *lb. approximately, and, therefore, the average flange stress approximates* $\frac{16{,}667 + 14{,}950}{2}$ = 15,800 lb. per sq. in.

For both bars = 31,500 × 2 = 63,000 lb.
Strength of welds (½ in. fillet welds s = 4,000 lb. per linear inch).
Total inches in welding required = 63,000/4,000 = 1575 in., use 16 in.
Inches of weld per joint = 16/4 = 4 in. net or 4½ in. gross to allow for endings.
Strength of Grip Bar (5 in. × ¾ in. × 1 ft. 4½ in.)
A = .75 × 5.0 = 3.75 sq. in.
Tensile strength at 18,000 lb./sq. in. = 3.75 × 18,000 = 67,500 lb.
This exceeds the design strength of both the welds and the joint bars.

These data suggested the following qualification tests Figs. 5 and 6, for the welders, it being assumed that no qualified welders would be available for these tests. The base metal for these specimens was specified to be of structural grade.

Results of Test No. 1[8], Fig. No. 5.

Welders' Designation	Coupon Number	Area	Yield Point, Lb. per Sq. In.	Ultimate Strength, Lb. per Sq. In.	Location of Fracture
P	2	0.7344	36,350	53,750	In weld
	3	0.7358	35,445	54,098	In weld
	5	0.7364	35,021	59,452	In weld
	6	0.7276	36,078	50,222	In weld
B	2	0.7290	35,635	51,870	In weld
	3	0.7294	36,840	42,244	In weld
	5	0.7235	36,795	42,940	In weld
	6	0.7189	37,125	47,079	In weld
T	2	0.7275	37,580	53,960	In weld
	3	0.7476	34,643	48,440	In weld
	5	0.7275	34,643	59,615	In weld

Welder "P" qualified in this test, averaging 54,380 lb., and maintaining a minimum strength above 50,000 lb. per sq. in.

Welder "B" failed to qualify in both average and minimum unit strength.

Welder "T" averaged 54,000 lb. per sq. in., but fell a little under the minimum strength required.

Note: In explanation of the range in unit strength between the several welders, it is remarked that none of these applicants had any previous experience in structural gas welding.

Ductility Observations—Coupons No. 1 and No. 4

Welders' Identification	Coupon Number	Per Cent Elongation in Welded Metal
P	1	17%
	4	9%
B	4	17%
T	1	19%
	4	10%

Test No. 2. Fig. No. 6.
Observation of Fractured Fillet Welds (guide)

Welders' Designation	Coupon Number	Remarks	Estimated Value
B	1	Weld metal quality fair. Some indications of over heating, ends not well fused to legs, penetration ⅛" shy, one spot 1½" in length less than 50% fused, average throat dimension ⅜", horizontal leg long.	Poor
	2	Weld metal quality satisfactory, average penetration to within ⅛" vertical leg fusion spotty. Average throat satisfactory.	Poor
	3	Average throat dimension 5/16". Penetration to within 1/16 to ⅛.	Good
P	1	Poor fusion and penetration. Weld metal good.	Poor
	2	Poor fusion and penetration. Weld metal good.	Poor
	3	Average leg fusion approximately 75%. Weld metal quality, good.	Poor
T	1	Fusion good, penetration to 1/16". Weld metal quality satisfactory. Average throat dimension ⅜".	Good
	2	Fusion good, penetration to 1/16". Weld metal quality satisfactory. Average throat dimension ⅜".	Good
	3	Same with exception of slight reduction in throat dimension averaging approximately 5/16".	Good

Test No. 3[9], Fig. No. 6.

Welders' Designation	Specimen Number	Ultimate Load in Pounds	Remarks
B	1	142,060	Left strap was bowed so that right side carried excess loading.
P	1	130,480	Failed at weld.
T	1	145,410	One strap tore where steel cross-section was reduced because of excess melting, simultaneous with failure of weld on opposite side.
T	2 (extra)	148,400	Failed at weld.

A review of these data designated Welder "T"[10] as most suitable and this welder was subsequently employed to weld the Test Specimen for the Committee, but not before being

QUALIFICATION TEST RESULTS

Base Metal Properties[7]

	Spec. No.	Size	Yield Point, Lb. per Sq. In.	Tensile Strength, Lb. per Sq. In.	Per Cent Elongation, 2 In.	6 In.	Per Cent Red. Area	Fracture
	1	.506	45,300	63,700	38.5		64.8	Partial cup and cone; silky
	2	.506	45,300	64,200	39.0		64.4	2/3 cup and cone; silky
(Long)	3	1.500 × .495	34,800	57,500	53.0	33.6	64.0	Silky
(Short)	4	1.500 × .375	38,600	61,200	50.0	31.7	64.5	Silky

[7] *Test reported by Union Carbide and Carbon Research Laboratories, Inc., Long Island City, N. Y.*
[8] *As tested and reported by The Forest City Testing Laboratory Co., Detroit Brook.*
[9] *As reported by Forest City Testing Laboratory Co.*
[10] *W. J. Thomas Welding Company, Detroit.*

given additional training in order to correct conditions responsible for the slightly low strength of his coupon No. 3 in Test No. 1.

The welding of the Committee's specimens followed and was conducted in the presence of members of the Committee. At the completion of welding the specimens were forwarded to the testing laboratory operated by the City of Detroit to be loaded to destruction. The results of these tests follows:

Results of Tests Made by Committee: (guide 10 cent bold)

(Note: These specimens, Nos. 1, 2 and 3, were painted with a thin coating of cement for purpose of aiding in the interpretation of tests.)

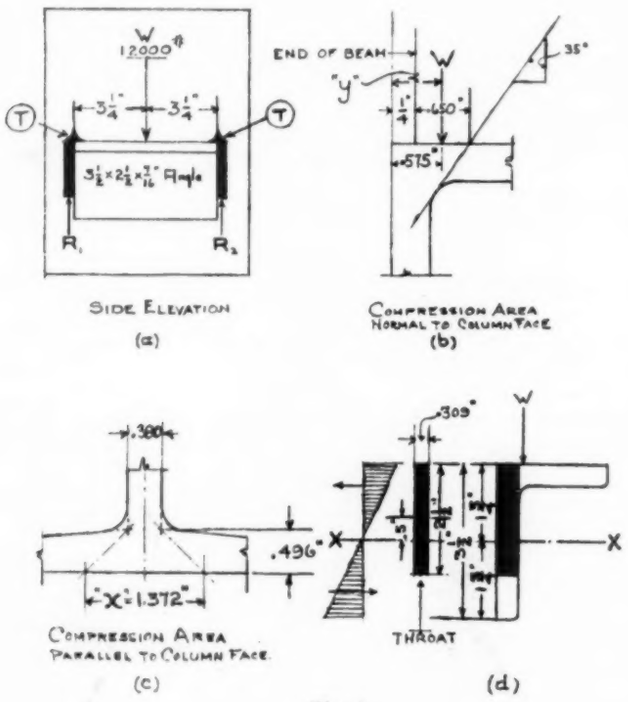


Fig. 4.

Figure No. 1

Working load per bracket	= 12,000 lb.
Max. load	
Beams 54,500/2	= 27,250 lb.
Beam seats 128,360/	= 64,180 lb.
Factors of Safety	
Beams	= 2.27
Beam seats	= 5.35

Remarks:

@ 37,500 lb. total load, first indication of yielding in the webs of 9" beam stubs.

@ Total load of 54,500 lb., the beam stubs which had been tack welded to the seats, failed by web buckling. These beams were removed and extension blocks placed upon the seats and the loading resumed. The load was increased gradually until at 128,360 lb. no further load could be applied due to detail fractures occurring in the upper terminals of the welds, which allowed the brackets to deflect between welds.

Fig. No. 2

Working load	= 18,550 lb.
Maximum load	= 77,270 lb.
Factor of safety	= 4.17

Remarks:

First indication of yielding occurred in the top flange just beyond the ends of the splice bars and at a total load of 47,000 lb.

At 77,270 lb. total load, the specimen had reached its maximum strength, failure occurring by detail crippling of the compression flanges, just beyond the ends of the splice bars.

Fig. No. 3

Working load of joint bars	= 63,000 lb.
Maximum load (joint bars failed)	= 196,930 lb.
Factor of safety	= 3.13
Average ultimate stress developed in joint bars	= 56,300 lb.
Average maximum strength per actual linear weld inch at point of failure of joint bars	= 11,000 lb. *approx.*

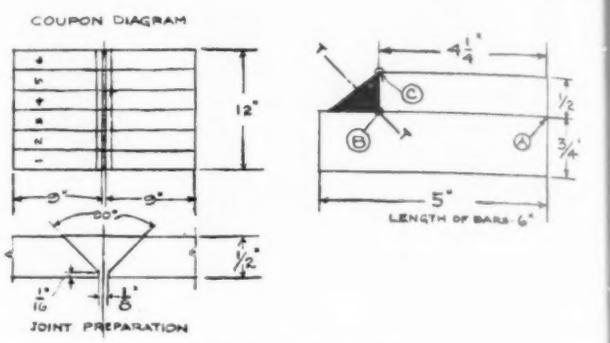


Fig. 5. Tests 1 and 2.

No. of Specimens Each Welder —1.
Position of Welding—Flat.
Reinforcement .....Min., 1/16"; Max., 1/8"

Test Requirements:

Tensile Strength—Coupons No. 2, 3, 5, 6.
Average .....52,000 lbs.
Minimum .....50,000 lbs.
Ductility—Coupons No. 1, 4.
Minimum Elongation by Miller Bend Test.....10%
Note—Coupons 2, 3, 5 & 6 to be Prepared in Conformity A. W. S. Std. dimensions for tensile coupons.

TEST NO. 1

No. of Specimens Each Welder —3.
Position of Welding—Flat.

Test Requirements.

Specimens to be Wedged Apart by Applying a Chisel Between Bars at "A" until Fracture Occurs. Inspection Shall Show Failure Thru Throat T-T, Penetration to the Root "B," Weld Metal Clean Appearing and Uniform in Texture. Edge "C" Shall Not Be Undercut More Than 1/16".

TEST NO. 2

Remarks:

Failure occurred in the joint bars immediately adjacent to the inside terminals of the welds in the upper half of specimen. Inspection disclosed undercutting of base metal, due to melting during welding, at the origin of break in upper joint bar.

At 119,000 lb. total load, uniform yielding of joint bars occurred as evidenced by flaking of cement coating. No other evidence of yielding at this load.

At 139,000 lb. total load, indications of yielding at the inside terminals of welds.

At 149,000 lb. total load, yielding progressing toward the center of all welds.

At 159,000 lb. total load, yielding general in joint bars and welds.

At 196,930 lb. total load, specimen ruptured as noted above.

Conclusions:

1. Aside from proving the feasibility of structural gas welding for the range of construction embraced in these tests, this episode again demonstrated the dependability of Welding Procedure Control from the standpoints of: First, disqualifying the untrained or unsuitable applicant, and second, indicating where a welder lacks in thoroughness with reference to a range of welding conditions which can be predetermined.

2. The prescribed welding designs provided ample reserve strength to safely withstand the assumed working loads of each specimen.

3. The design procedure determining the welding about the brackets of Fig. 1, while admittedly being irrational in several respects, provided a simple and economical means for limiting the end or terminal stress to within conservative limits

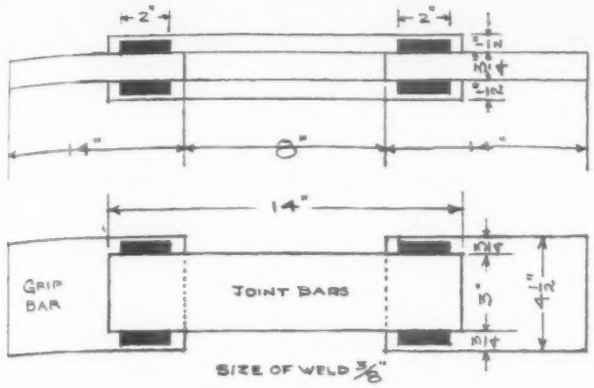


Fig. 6. Test No. 3.

No. of Specimens Each Welder—2.
Position of Welding—Flat.
Working Strength of Specimen:
Welds—4 (3,000x2) @ 11,300 lbs. = 24,000 lbs.
Joint Bars—2 (.5x3.0x16,000) = 48,000 lbs.
Grip Bars 0.75x4.5x16,000 = 54,000 lbs.
Probable Working Strength of Welds:
Actual Weld Length, 2½".
Average Size of Weld = ½".
Corrected Working Strength = 4 (4,000x2.5) = 40,000 lbs.
Test Requirements:
As Designed (24,000x3.5) = 84,000 lbs.
As Corrected (40,000x3.5) = 140,000

TEST NO. 3

and it was observed that the estimated ultimate terminal stress at failure was in close agreement with the maximum strength of the weld metal produced for these tests.

Material Handling in Arc Welding

(*Continued from page 38*)

It is true, of course, that getting the job into a position to make all fillet welds in a downward position involves the use of adequate fixtures for the purpose. It is quite common to see a welding operator without such fixtures tie up a whole shop by insisting on holding a job with the "big hook" from an overhead traveling crane while he welds fillets in the downward position. If there is any other work going on in the shop which requires the use of the crane, such practice is far too expensive to tolerate.

Nor does the welding of fillets in the sidewise position produce the proper contour for a fillet weld. Figure 1 illustrates a fillet (on the right) made with paste-covered rod in the sidewise position. On the left is shown a section of the companion fillet made in the straight downward position. It is obvious that the sidewise fillet will cause stress concentrations to a far greater degree than the properly made fillet. It costs twice as much to make the improper fillet as it did the correct one, due to higher deposition rate in the latter case. Figures 2 and 3 show side views of the two fillets.

As the size and complication of welded steel parts increases, the problem of handling revolves around the matter of speed and ease with which the pieces can be handled on the welding table. Figures 4 and 5 illustrate pieces which must be placed in at least twenty positions in order to complete the fillet welding in the downward position. Rather than call the crane twenty times, or hold up the crane while the job is completely welded, it costs less to make the welding table top movable. The Harnischfeger Corp., of Milwaukee, Wis., was confronted with this problem and solved it with very great economies by the use of specially designed welding tables, electrically operated, and overhead hoists. The manufacturing economies were sufficiently impressive to justify an investigation of the advisability of offering to supply other manufacturers with this equipment.

The very nature of the problems encountered in the weldery involves material handling on a very economical basis. Welded assemblies of from two to fifty individual members obviously make matters complicated. In some shops, the condition has already been reached at which it is necessary to either provide additional overhead traveling cranes or work out some combination of welding tables and hoists to handle the work economically. In many cases the latter plan costs considerably less.

Correspondence Course in Design For Arc Welding

A complete course in designing arc welded structures has been prepared by the Wilson Engineering Corporation, College House Offices, Harvard Square, Cambridge, Mass. The present layout of the course includes 23 lessons. The first five of these lessons are of general character to familiarize the student with the nature of the work and with the characteristics of the welding processes. In succeeding lessons are treatments of drawings for welded structural steel, metallurgy of iron and steel; structural steel shapes; strength of fillet welds; beam assembly supports; beams with fixed ends; welding practice, estimating, alterations and repairs, concentrated loads, erection problems, plan reading, column design, inspection, miscellaneous welding instructions, plate girders, battle-deck floor construction, roof trusses, compound fan trusses, mill buildings, plate work and bridge trusses. The text book material includes a 209 page handbook devoted to structural steel work, a 146 page dictionary of technical and trade terms with a 13 page supplement, A. I. S. C. Handbook; 208 page arc welding manual; 98 page welding dictionary and a loose leaf binder. There are approximately 1700 pages of lesson and instruction text including handbooks and dictionaries. This course in the design of arc welded structures is offered to men with previous experience in designing structural steel with riveted connections. A course called "Steel Designing for Arc-Welded Structures" is offered to men with no previous experience in structural steel designing and is really a combination with a special course in structural steel designing which is also offered by the Wilson Engineering Corporation. The special course on the design of arc-welded structures is $60.00 per student and the combination course is $120.00 per student.

As an example of the practical scope of this course, it is noted that in one of the lessons there are given details for a riveted plate girder which is to be redesigned as a welded plate girder. In another lesson a blue print is furnished showing a compound fan truss designed for riveted connections. The student is required to redesign this truss for welding and to make an estimate for the riveted design and the welded design. Still another problem is the complete redesign of a small mill building which was originally designed for riveted construction. A comparative test of the weight of steel in the two designs is then required. Officials of the school report that the course started on May 1, 1931, with a very satisfactory enrollment which is still growing. The instruction is given by mail only. This is the sort of instruction for which there is a real demand and there is a considerable factor of convenience in that it is possible to start at any time and work through the course at one's convenience.

Hard Surfacing on Street Railways

According to the 1931 report of the Oxy-Acetylene Committee of the International Acetylene Association, hard surfacing is employed extensively in the construction and maintenance of electric railway roadbeds. Some of the machine parts on which the hard facing material has been applied with resulting economies are Jordan spreaders, tie tampers, hand shovels, weed discing equipment, scarfing saws for track maintenance, and many other parts of equipment used for roadbed construction and maintenance.

Arc Welding Sheet Metal*

Important Savings Are Made in Both Raw Material and Labor—Welder's Time Is Saved by Having a Skilled Assembler on the Job with Him

By E. P. Bestler†

THE purpose of this discussion is to bring out the advantages of fabricating by arc welding over the old system of riveting and soldering. It will cover the work carried on in our own shop, where welding methods have been developed gradually over a period of years.

The requirements of our products are such that the welds do not have to stand test up to any great degree of pressure, but they always call for a dust-tight job. About nine years ago 100% of our work was constructed of galvanized sheet steel riveted and soldered. Today, I can safely say about 95% of our work is constructed of black iron, welded.

In the first place, there is a saving of about 28% in the raw material. Second, there is a saving of about 50% in labor—I do not mean to state a 50% saving in all classes of work, but safely can say about 75% of our production shows this saving over old methods.

One very important point of saving is in the laying out of the different shapes and forms which we fabricate. In developing a pattern for the riveted process, there is a great deal of time lost in laying out the rivet spacing and proper laps; whereas in developing a pattern for a welded job, you cut on the developed line and you're through; that is, providing you cut on the line.

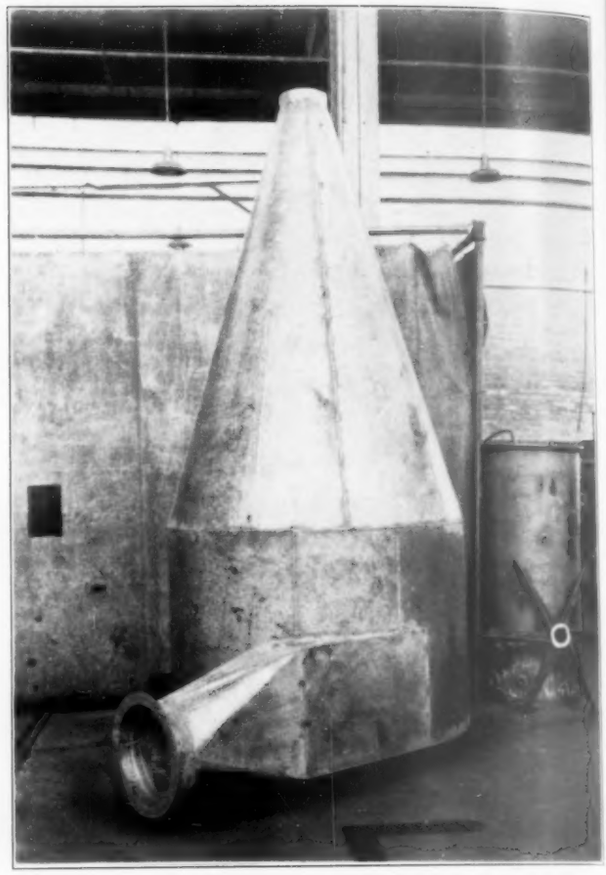
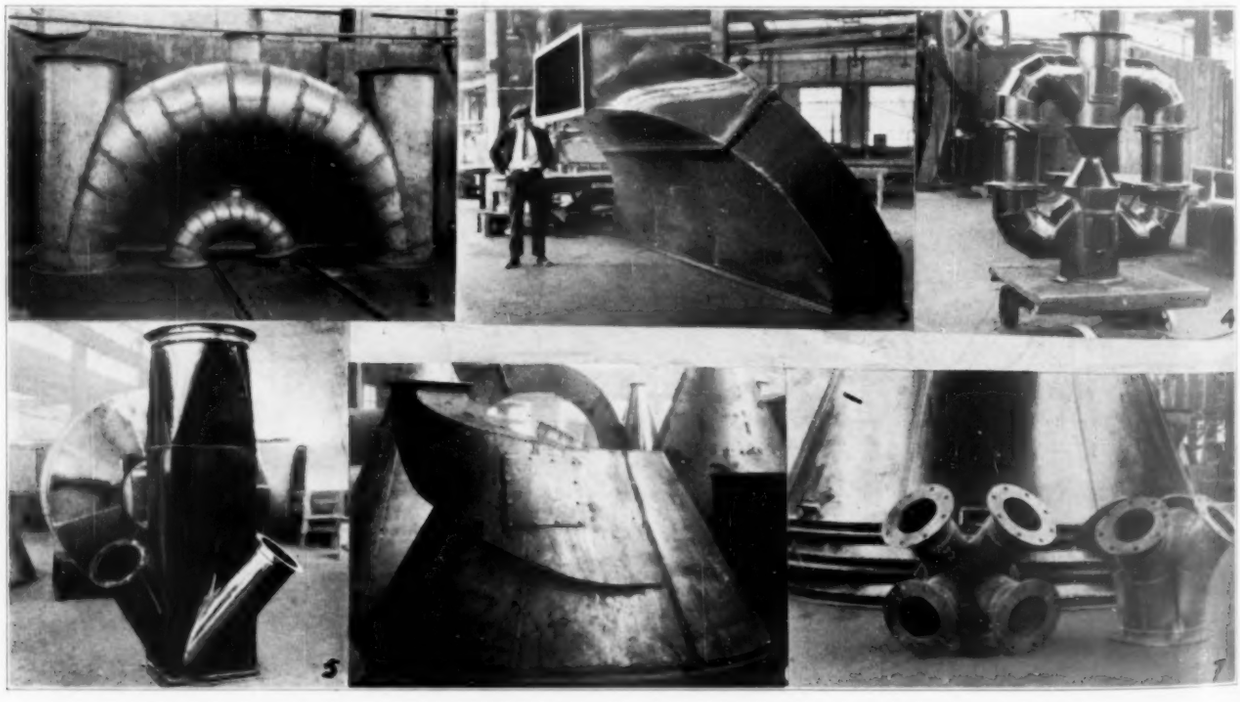


Fig. 1. No Rivet Heads to Wear Off. No Material Wasted in Lapped Joints.

In cutting out the many shapes of sheet metal parts, there is a saving of time and material. Take for example, a plain cone as shown in Figure 1,—8 ft. diameter on one end, 1 ft. diameter on the other, and 10 ft. high, made of ⅜" tank steel. There is a saving of $1.00 or more in material by butt weld-

*Paper read before American Welding Society, Chicago Section, Jan. 9, 1931.

†Supt. Sheet Metal Dept., Raymond Brothers Impact Pulverizer Company, Chicago, Ill.



Figs. 2 to 7. In Many of These Arc Welded Products, Design is Simplified and Fabrication Costs Reduced.

ing in place of a lapped and riveted joint; and by making a butt welded job of it you have a much smoother job. There are no rivet heads to wear off by the tons of material passing over them, which is the kind of wear to which our products are subjected. Most of our work is shipped in sections and put together with angle iron rings and flanges; therefore a big saving in time is effected by not having to draw in the large end of this cone to allow for riveting.

In the general run of angles of any degree or size, gauges from No. 12 and heavier, there is a great saving of time by butt joining them, doing away with hammering out and drawing in of the edges to make one and slip over the other (Fig. 2).

The fabrication of a compound angle or of a job like that shown in Fig. 3 would be a difficult matter if we had to turn over the edges and rivet or form an angle to fit into the corner. It certainly would be hard to figure out how to hold the dolly to buck up against the heavy hammer blow. We encounter no trouble at all in assembling a job of this sort. We make a corner weld wherever we can in rectangular and square work, making a very fast and good looking job.

Referring to Fig. 4, a piece of work of this sort, called a three-way branch, we find it much less work to assemble for welding. Just butt the parts, weld, and cut out the different openings with the torch after the job is completely welded. What a lot of rivet heads would show up inside of this connection if it were riveted so as to make it dust tight!

In constructing a piece of work as shown in Fig. 5, there is a great deal of time saved by the absence of flanging, punching and drilling.

Fig. 6 is a piece called a four-way distributor. In general practice, it was made of cast iron, but owing to the short time allowed for the job, making wood patterns and spoiling one or two in the mold, our Engineering Department decided to make it of sheet steel and owing to the tons of material passing through this connection, it was made of ¼" tank steel. In two or three days from the receipt of the order, the distributor was on its way. The large end was 14" diameter and the small ends 7" diameter. The dimensions did not vary 1/8 of an inch in all directions. The ends of each branch came up to within a few inches of the large end or inlet end, tapered off to help direct the material. This is a piece of construction to be proud of and one which would be almost impossible to make by any other method than a welded job.

Figure 7 is a job requiring a sort of compound curve. Just try to drive rivets in those corners! What a nerve racking job it would be! You will surely have to watch your step in laying out, as well as forming a piece of work of this sort, even if you weld it.

Fig. 8 is an all welded Fan Casing—an absolutely dust tight job, usually made of ⅛", 3/16" and ¼" material. By using the corner weld in this construction, it makes it a very nice job to weld; and in most cases, we line these shells; being smooth inside makes it an easy task to line them.

In our lighter gauges—No. 14 and lighter—we use the lap weld in the large diameter pipes and elbows, using a spot welder to do the assembling, which brings the joints tightly together and makes a much faster weld than a butt weld in the lighter gauges.

We make most of our pipe flanges of rolled angle iron with the joints oxy-acetylene welded. We use the torch for the reason that it makes a stronger weld and requires no grinding after the weld is completed.

We have two classes of workmen in the welding department; namely, assemblers and welders. The assemblers work in pairs and only tack the work together; then lay it aside for a welder to complete. The result of this is that all men concerned are kept busy at all times. We do not have a man waiting for some one to give him a hand or have a man standing around watching the other man weld; and in my opinion, you need expert assemblers as well as welders.

In selecting your man for an assembler, bear in mind that he must be a man who can read a blue print or sketch and have mechanical ability. Not being a productive shop, we cannot use fixtures for our class of work, and therefore it requires men who can measure up and check a piece of work after assembling it.

We generally select men who show an inclination to become welders, and put them to work as an assembler helper. If they show any interest in the work, we give them the

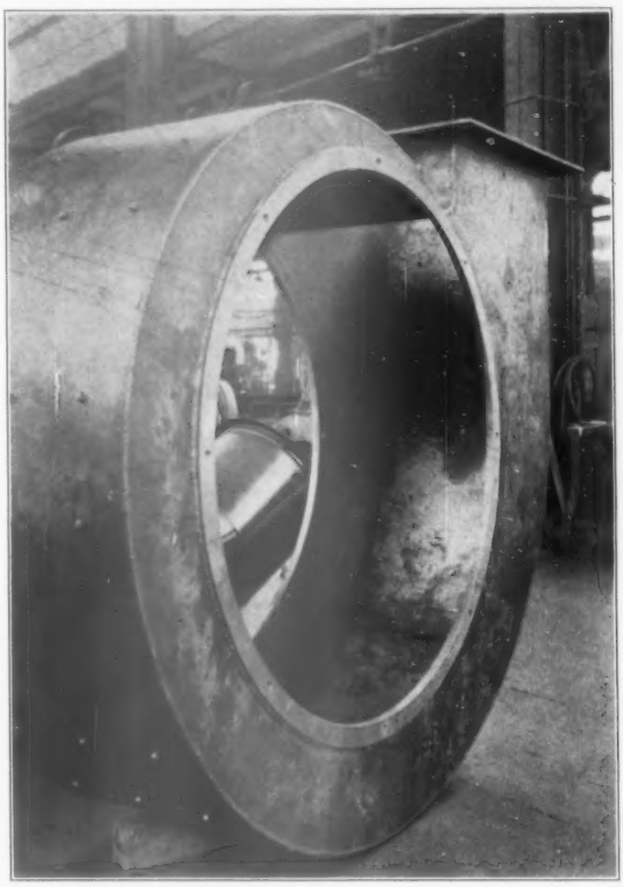


Fig. 8. Three Different Thicknesses of Material Are Welded Together.

right to play with the arc whenever they see an opening, and with the proper supervision of the experienced welder, they become good welders and assemblers.

We use nothing but a coated wire, as we have both A.C. and D.C. machines. We aim to have a good appearing weld as well as a ductile weld. We take a great deal of pride in our work and we are pleased to say that we have a very good force of welders. Our standard of welding is rather high, and in breaking in new men we keep after them until they show a marked improvement in their welds, before we expect any footage from them. We generally inspect our welds by the depth of the crater, and the discoloring of the metal caused by the heat of the weld on the opposite side of the weld, as well as the appearance of the weld itself.

We use a ⅛" in electrode for No. 14 gauge, 5/32" for No. 12 and No. 10 gauge, 3/16" for 1/8" gauge, etc.

The amount of amperes or heat as we term it is governed by the welder himself. We generally use around 125 amps. for No. 10 where the joint fits fairly close together and are butt joints.

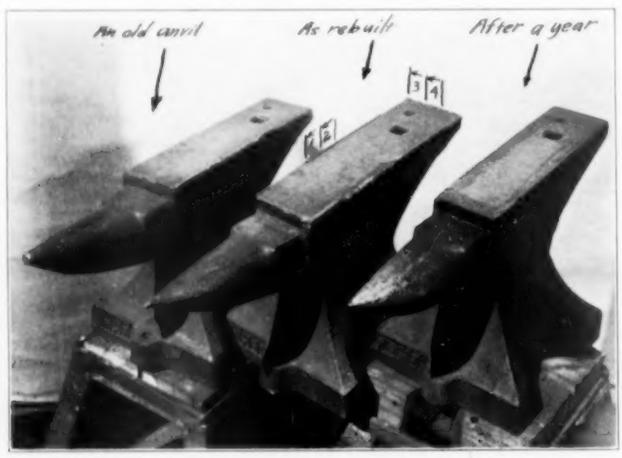
Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

Repairing Anvils With Carbon Arc

By E. D. Soderstrom

We have twenty-four anvils, all of them more than twenty years old. The edges of most of these anvils were badly chipped, and the tips of the horns were blunted up. The proposition of putting these anvils back into shape was on my mind for some time. I finally concluded to try rebuilding the edges with the carbon arc using Oxweld No. 5 tool steel filler. I rebuilt the first one September, 1930, and the rest of them before January 1, 1931. These anvils have now been in use from eight months to a year, and the procedure has been proved successful. The picture shows one anvil that has been in use for a year, one just after re-building and one as it was before.



Arrows on Center Anvil Show Order of Welding.

The method of procedure follows:

Grind a long pencil shaped point on a $\frac{5}{16}$" carbon.

Set the machine to give 95 to 100 amperes.

Use a $\frac{5}{16}$" tool steel filler fluxed with a little borax.

Weld in a bead of about one and one-half inches at a time and weld backward; that is melt into the edge with the arc and follow up with the filler. This makes it possible to deposit metal with least amount of heat and agitation. Strike the arc on the side of the anvil and bring it up to the edge.

Use the step-back method; that is weld Nos. 1, 2, 3, 4, etc., as indicated by arrow, deposit two steps in any one location, then go to another edge.

Any attempt to deposit long large beads in a continuous direction results in heat cracks. Where large pieces have been cracked out, make the fill with two or more beads, letting the place cool off between deposits. The carbon should be oscillated back and forth along the edge closing in towards anvil edge on forward swing so as to melt into edge, then back and lengthening a little to fuse in some metal from the rod. The length of the arc will vary between $\frac{1}{4}$" and $\frac{3}{8}$".

The anvils are finally finished by grinding to true up face, edge, and tip. This is accomplished by hanging anvil in a sling suspended from a small chain hoist in front of grinder stand.

The filled in edges, by following above procedure, will cool fast enough to leave the anvil edges fully hard enough. The grain of the steel will be somewhat enlarged, but with the solid backing of the anvil body the filled in metal holds up very well. I have also used the above process on the edges of jaws of blacksmith's type leg vises.

Note that the anvil bases are made of arc welded channel iron with wood facing.

Application of Bosses by Welding*

A complete design is a combination of elements properly arranged.

Often when the elements are located as required the design appears complicated in appearance and costly for manufacture. The ease with which the elements, units or parts can be fused into the framework as a whole by arc welding, offers appreciable production economies. For example, consider a base or framework in which bosses, pads or similar elements are required.

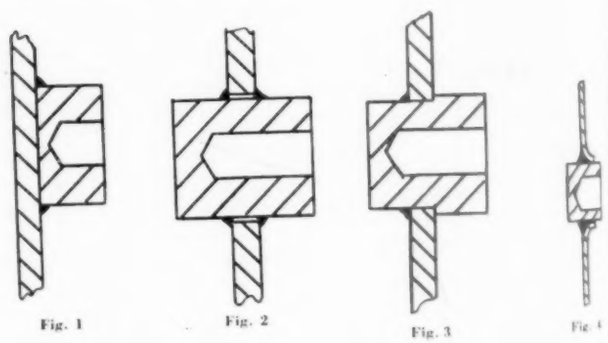


Fig. 1 Fig. 2 Fig. 3 Fig. 4

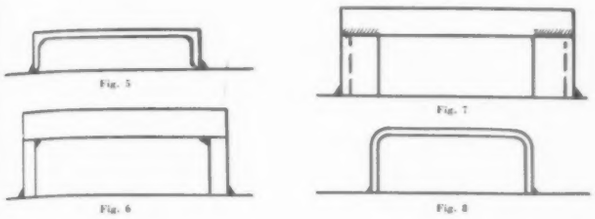
Stud bosses may be applied in various ways, depending upon their functions. In Fig. 1 the boss consists merely of a piece of round bar stock or shafting fused to the supporting member by a fillet weld as shown. This boss may perform as supports for other parts. If tapped as indicated it may serve as a stay rod connection or may support a slotted bar used for adjustment purposes. If this design appears as fragile construction, weld such a boss in place as indicated and then try to knock it off with a heavy sledge.

The boss shown in Fig. 2 may be either drilled or tapped. It may serve the same purpose as the boss shown in Fig. 1. However, this design permits use of a longer stud. The boss is inserted through a hole in the supporting member. Fillet welds around the circumference of the boss, as indicated in Figure 2, hold it securely in place.

*From "Application Sheet No. 24" by courtesy of Lincoln Electric Co.

When it is advisable to drill a hole in the supporting member and where a finished boss is desired on one side of the member, the type shown in Fig. 3 may be used. The hole in the supporting member locates the boss and the boss is permanently secured by a fillet weld as indicated in Fig. 3. The shoulder on the boss acts as a stop on the opposite side from the weld. This type of design is often used in gear case construction where a machine boss on the inside is required and the space available is limited.

Bosses in thin plate and sheet metal are often designed as shown in Figure 4. A hole of slightly smaller diameter than the outer diameter of the boss is punched in the supporting member and the boss forced through the punched hole. A fillet weld is applied as indicated in Fig. 4.



All the bosses shown on this sheet may, of course, be drilled all the way through, and in such cases serve as shafting or lever rod supports.

Bosses may also serve as pads to provide proper mounting of equipment. For example, the type of boss shown in Fig. 1, may serve this purpose. However, mounting pads may be made in any size or shape. Square bar stock can also be used instead of round if desired.

Where pads of considerable area are required and of a fraction of an inch in height, steel plate cut to the required dimensions and fillet welded to the supporting member will serve. Where necessary, the pad may be milled before welding to the supporting member. Where such type pads are required but of greater height, they may be built up of structural shapes or plate, as indicated in Figs. 5, 6 and 7, or in cases of mounting light equipment plate may be formed to the required dimension and shape on a bending brake. An example of this type of mounting pad is shown in Fig. 8.

Convenient Welding Table Is Designed by Shop Owner

A convenient table for use in handling small welding jobs was recently designed and built by Joseph Fritsche, proprietor of the Puente (Calif.) Welding & Blacksmith shop. A view of this table, the top of which revolves, is shown herewith in use in the rear of the welding department of the shop. By its use the piece of work being welded can be turned around and welded from any angle desired without the welder moving his position. By merely turning the top of the table to the position desired, the operator can proceed with the welding operation, thus eliminating the necessity of walking around the table, dragging his hose after him and having to watch to keep it from catching on the object being welded or other equipment. Mr. Fritsche also points out the fact that often visitors and onlookers in small job shops become so interested in watching the welding operation that they thoughtlessly—or through ignorance—step on the hose, stopping the proper flow of gas or air. By keeping the hose on one side of the table and next to the operator, mistakes of this nature are reduced to a minimum.

Construction of the table is simple and inexpensive, the top being a large discarded compressor head secured to a flanged six-inch piece of old pipe which acts as the main supporting member. The revolving feature of the top of the table is by means of a piece of 5⅝-inch pipe set inside the outer one with a wooden plug inserted flush with the top end. A piece of plate iron cut to fit inside the outer pipe and on top of the inside pipe affords the surface for ball bearings which are placed on the plate and on which the table top rests. An iron rod run through the wooden plug and extending through the plate acts as a spacing medium for the bearings. The inner pipe is cut in two about half way up from the floor, thus affording a stationery outer base around which is attached a shelf, as shown, which is convenient for tools, fittings, setting-up blocks and other material. The base is of ordinary scrap iron common to any blacksmith or welding shop.

Home-Made Revolving Welding Table.

The top of the table being 1⅝-inch in thickness, affords sufficient strength for any ordinary job, and, having the bolt holes at the outer edge, it is often found convenient in many jobs by affording a means of using extension tools, etc. These holes also afford a convenient and safe place for the welding torch when not in use, as is illustrated in the photograph.

Mr. Fritsche has had 14 years of practical experience in welding, and has invented and built various labor-saving tools and safety devices, as well as planning and arranging his shop equipment in such a manner as to effect a great saving in time in his work. For example, the main drive shaft and pulleys which operate the various machines in Mr. Fritsche's shop are anchored in a concrete pit underneath the floor of the shop. The elimination of all overhead shafts and pulleys, together with the advantages of shorter belts have been found to be a great improvement.

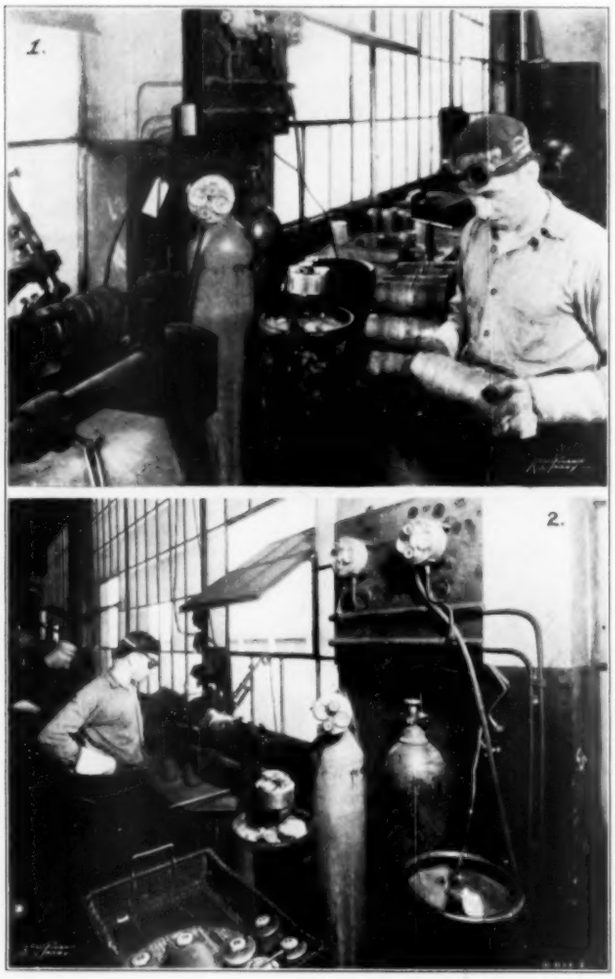
Speeding Up Production

By Earl Evleth, Service Engineer
The Bastian-Blessing Company

In high speed mass production, individual small parts must reach the assembly line in perfect condition and at a uniform speed or the entire plan of production will fail. "Fit and try" methods of assembly cannot be employed. Parts must be in-

spected and tested at the earlier stages and imperfect materials rejected before the final assembly. Neglect of detail is ruinous. Under any system which permits neglect, production schedules fail and costs mount to prohibitive levels.

The Norge Corporation of Detroit, Michigan, builders of electric refrigerators, introduced their unit into a highly competitive market. Price levels were already established which had to be met. The profit margin did not permit fluctuations in manufacturing costs. Strict maintenance of a production schedule and low operating costs were essential. Failure of any detail of the plan meant loss of profit.



Semi-Automatic Welding Machine Reduces Failures to Less Than 1 Per Cent.

Among the numerous problems encountered was the fabrication of the refrigerant liquid receiver. This is a 14 gauge steel cylinder 4 in. in diameter by 10 in. long made from two cup-shaped halves, joined at the center girth seam by welding. The original specifications required the use of the oxy-acetylene process with hand operated torches but difficulty was experienced from the start in obtaining uniform results in appearance and freedom from leaks. In addition to these troubles the production output varied from day to day.

The problem was then submitted to The Bastian-Blessing Company, Chicago. After intensive study a proposal was submitted, advising the construction of a special welding machine substantially as shown in Fig. 1. The production estimated by the Engineering Department called for 41 completed welds per hour with a gas consumption of 0.59 cubic feet of each oxygen and acetylene per piece. A change was suggested in the shell design to provide a projecting flange $\frac{1}{32}$" high on each end of the receiver cylinder halves, thus eliminating the use of welding wire in the operation.

The machine is simple in design. It consists of a horizontal spindle on which is mounted a quick operating chuck to hold one-half of the cylinder. The other half is held in alignment and contact by the tail stock collect. The variable speed friction drive and gear reduction to the motor are shown clearly in Fig. 1. The torch, with a special multiple flame tip, is mounted on a bracket arm above the work at an angle of 45°. The bracket arm has screw feed adjustments in two directions to permit proper location of the welding flame in relation to the weld seam.

The machine is semi-automatic in operation. The direct current motor is connected through a rheostat permitting a slow start to bring the metal to fusion temperature, with increased speed as the weld progresses. Solenoid valves connected to the rheostat handle shut off the gas supply when the motor feed is stopped and an electric spark ignites the gases when the motor is started. The work revolves towards the operator so that the finished weld is always in full view. A uniform, steady flow of gas pressure is essential and this is supplied by two-stage regulators.

The results over an operating period of several months, are the decided interest. The actual production of finished welds averages 45 pieces per hour with a gas consumption of 0.53 cubic feet of (each) oxygen and acetylene per piece. The investment in this machine which is now operating on two shifts has reduced the cost of the operation more than 50 per cent. All of the receivers are subjected to a hydrostatic test pressure of 1500 pounds per square inch with less than one per cent rejects for leaks! The weld is perfectly smooth and uniform and requires no grinding or finishing before enameling.

Welded Floating Roof Tank in China

The first electric arc welded Wiggins Floating Roof in China has recently been completed by the Yuen Chong Tai Iron Works. The shells of these tanks were all hand-riveted by native laborers. Fig. 1 is a view of the deck after the plates were laid and tacked and gives an idea of the care with which the Chinese welder works. The plates were $\frac{3}{16}$" thick and the diameter was 10 ft. The shielded arc type of electrodes were used, welding being done with positive polarity. Yuen Chong Tai, the proprietor of this organization considers that this first welded roof is somewhat of an experiment because the coolies and welders employed on the job had to be broken in on it for the first time. Some difficulties were experienced due to the newness of large arc welding operations, the lack of welding supplies and the difficulty of accurate estimating of the requirements. The machines used were of 200 and 300 amp. capacity and driven by gasoline engines. This job was done for the Shell Oil Company. Mr. W. A. F. Millinger, Mechanical Engineer and Welding Consultant of the Shell Oil Company and also divisional vice president of the American Welding Society for the Pacific Coast district, was in Shanghai during the progress of the work and made a personal inspection of the job. The success of this construction is indication that more work of this kind will be done in the future in that country.

Left, The Completed Tank. Center, Yuen Chong Tai and W. A. F. Millinger. Right, View of Deck After Plates Were Laid.

Building a Job Welding Business

By W. Irving Brockson

VII—Using the Telephone to Sell

"I TELL you, Jim, if you are in business to make money, you can't sit around and wait for work to drop into your shop from the clear blue sky, like the bread in Biblical times dropped from heaven. Miracles just don't happen any more.

"You've got to get out and scratch for every job, especially in these times. Not only must you be a jump ahead of your competitor, but you've got to create welding work where none existed before. I mean by that, you must show the plant that has never used welding how to profit by it—substitute welding for other mechanical operations, etc. And don't overlook a bet. Use every means at hand to create those welding jobs."

So speaking, during the Boston convention, Rock Smith, one of the most successful job shop operators in the Central West, "said a mouthful" to an old friend. Rock might have gone on to explain how many shops are making very effective use of the telephone to do creative selling.

Telephone Selling Is Inexpensive

One reason why telephone selling is good practice is found in its low cost. Most business telephones are installed on the basis of a monthly rental, and the rate is the same, within certain limits, whether you make a few calls or many. Under such conditions, if you use your phone but little, you are not "getting your money's worth." It may even pay to make an occasional toll call, assuming you know your man; have a definite message to give him and organize what you have to say, so you can get it over quickly and effectively.

Another reason why the telephone is an effective sales tool is that it can be used at "odd times" or "in between jobs." You don't need to leave the shop or take time to "change your dirty breeches" as you probably would if you went out to make a "first time, cold turkey" personal call.

A Definite Plan Is Necessary

To be successful, a telephone selling campaign must be conducted according to a definite plan and must be preceded by some "ground work." This plan should be built largely around two considerations; namely, (1) Who you are going to call, and (2) What you are going to say.

In the first place, who are the people to call? Until you have gained some experience selling over the 'phone, you will do well to restrict your calls to persons you know.

Calling Old Customers. The group of people with whom you are most likely to have success over the 'phone is your old customers. These people know you and will give attention to what you have to say. Furthermore, your knowledge of their requirements should be rather comprehensive and you are better prepared to present to them than to others new proposals for welding service. You can make your suggestions definite and specific from your knowledge of their plant, their equipment and their business. In some cases, if you know your man well enough, you can keep him reminded of your shop simply by calling him up and "kidding him along" on personal items and the news of the day. This, however, is not recommended as general practice.

Prospects Called on But Not Sold. It is assumed that in the regular course of your business building program you will make personal calls on prospects from time to time. A few of these, after one or two personal visits, you will be able to develop into customers, but the majority of them will remain on the prospect list for an indefinite time.

In 'phoning these prospects, you should have an individual question to discuss with them upon each call. Something which was discussed during your previous visit can be used as a very satisfactory basis for opening remarks. From your contact with them you should be able to decide what phases of your work they could best use or what classes of jobs are of most interest to them. For instance, today you may have done a very successful job in using some new alloy rod. If you believe you can do a "bang-up" job for one of your prospects with this same rod, call him and tell him about it, giving your reasons.

You may have read an experience in *The Welding Engineer* which seems to fit the case of another prospect. If you are prepared to do the work, by all means call your man and let him know about it. In talking to these people upon whom you have called but never sold, your 'phone presentations will be more successful if they deal with matters of specific personal interest to the prospect than if they consist of "glittering generalities."

"Cold Turkey" Phoning

Talking over the wire to firms you have never visited and to men you do not know is the most difficult kind of telephone work, and should not be tackled until you have had considerable experience. Yet, when properly handled, it can pave the way to considerable business.

This work requires some preliminary effort which should include (1) the gathering of information from outside sources about the products manufactured; (2) the kind of plant maintenance work involved; (3) what the company is now doing with welding, either from other job shops or in their own plant; and (4) the names of the men who should be called.

With this information in mind, one conversation might be something like this, following the preliminary remarks to determine whether you are talking to the party desired:

Job Welder: "This is Brown of the XYZ Welding Company. I should like to ask if you are using welding to reclaim rejected castings in your foundry?"

Prospect: "No, I don't think it would pay us to do it."

Job Welder: "Mr. Prospect, you will be interested to know that we have been doing that sort of work for the Humpty Foundry and the Gimpty Mfg. Company for a long time and have saved them considerable money."

Prospect: "Their business is different from ours."

Job Welder: "That's true, Mr. Prospect, but we've learned a lot about reclaiming castings in working for those companies. Tell you what I'd like to do. I'd like to come over to your place and look over your rejects and see what I think we could do. If I'm convinced we can make you a saving, I'll present you a definite figure. If not, no harm done, and you are under no obligation in either case. What do you say?"

One of the important things to look to in telephone selling is your voice. If you have a harsh, booming or squeaky voice, you should correct it before you try to do much work "with receiver to ear."

Courtesy Is the Master Key

Another thing to which you should give special attention is the question of courtesy. This quality springs naturally from a true desire to be of service to others. Bear in mind that selling consists to a large degree in persuasion—in getting the other fellow to do what you want. If you are overbearing, domineering or "tough" in your manner, you won't get very far. Keep in mind that when you get a man on the wire, you frequently interrupt something else he is doing; often it is necessary for him to walk clear across the plant

to get to the 'phone. In any case you are taking up his time and he has not invited you to do it. Under such conditions, if you are not tactful, courteous and considerate of the other fellow's position, your call will do more harm than good.

Know What You Are Going to Say

A prime requisite of successful telephone selling is that you plan what you are going to say. You don't need to memorize it to "rattle off" like a parrot, but it is essential that you have clearly in mind the main points of your story. It is suicide to get the receiver to your ear and expect to have some inspiration which will tell you what to say. If you expect to open your mouth and have "the Lord fill you with wisdom," you are "riding for a fall." First, analyze your proposition in the light of the customer's requirements. Just why should he be interested in that airplane skid shoe that you have recently hard-surfaced or in that gear that you have just reclaimed? Where does it fit into his business and how will he profit? After you have the main points in mind, decide what is the best way to introduce and present the subject to the prospect. Thus fortified, you are ready to give your man the buzz, *and not before.*

It is important to bear in mind that your conversation over the 'phone must be clear, explicit and designed to bring up correct impressions in the other fellow's mind. You can't show a sample or a picture, use gestures, or make drawings or sketches as you talk. The whole impression must be made by the words you use and how you use them.

You should strive for immediate orders, to be sure, but the principal value of telephone work is classified under "reminder good will." When you call, you keep your man from forgetting you. He is more likely to remember you when he has work to be done. You are establishing yourself in the good graces of your prospect by a means which competition is not likely to use.

Working From Your Records

Some firms have a very successful plan of keeping a little file of the firms they have on their 'phone list. They keep not only the firm name, 'phone number, person's name, but also a few very brief notes on what has transpired before. This enables them to start right in on the second 'phone conversation at a point of interest to the prospect.

If you have followed the suggestion made in a previous article to the effect that for your direct mail advertising plans you keep on three by five-inch cards a list of your customers and prospects, these notes for the telephone work can be combined with the mail advertising work.

Figure It Out for Yourself

With little expense a couple of hundred people can be contacted at regular intervals. For example, if you only make two constructive calls a day but keep it up consistently you can make about fifty calls a month.

Now, "Go into a huddle with yourself." During the last three months how many honest attempts have you made by personal call or by telephone to get new business? How many jobs from new customers did you get? If you had followed a systematic program, similar to that outlined above, is it not reasonable to believe that your volume of new business—the factor which determines whether you are going ahead or slipping back—would have been much larger?

Stabilizing the Alternating Current for Arc Welding

By J. B. Gibbs
Transformer Engineer Westinghouse Electric and Manufacturing Company

IN RECENT years, the field of arc welding has been enormously expanded by the introduction of new and more convenient methods. Alternating current welding transformers have been studied with a view to improving the operating characteristics and progress has been made in that direction by the development of a new type of transformer, in which an oscellator is used to stabilize the arc and thus make the alternating current more easily handled for welding purposes. It appears that the idea of using an oscillator for stabilizing an A-C arc was suggested as long ago as 1879 but that little, if any, use was made of it.

The action of the oscillator can perhaps best be understood by thinking of the arc as a path in which the gases are ionized. That is, the gases in the arc path may be thought of as broken up into electrically charged particles which move with great velocity from one electrode to the other, and thus make the arc path, in effect, a good conductor. The velocity and the direction of motion depend on the voltage.

Ionization can be produced in several ways. If a body is sufficiently heated it gives off ions. This is the condition in the electrodes of an ordinary arc, or in a radio tube, in which the heated filament gives off the ions which form the conducting path. Another source of ionization is a high voltage. The most familiar example of this is a lightning stroke where the voltage between the cloud and earth or between cloud and cloud is built up to the point where the intervening air is ionized, and thus forms a conducting path through which the lightning stroke occurs.

When a D. C. welding machine is used, ions flow continuously in the same direction and there is no tendency for the arc to rupture unless it is drawn out to such a length that the voltage of the machine cannot send current enough through the resistance of the arc. With an A. C. arc, however, the current stops entirely twice every cycle. At this instant there is no flow of ions from one electrode to the other and unless the electrodes are hot enough and close enough together to keep the intervening space ionized, the arc goes out. The A. C. arc is thus inherently less stable than the D. C. arc.

The oscillator remedies this by applying to the welding terminals in parallel with the welding current a high frequency discharge at a comparatively high voltage. This keeps the arc path ionized all the time, so that it is not even necessary to touch the electrode to the work in order to start the arc. Merely bringing the electrode within welding distance of the work causes the arc to start itself.

A high open-circuit voltage is unnecessary because the welding transformer does not have to break down an initial resistance. A high frequency circuit does this. The arc is not extinguished by the small involuntary motions of the welder's hand, and if it is accidentally broken, it is instantly re-established as soon as the electrode is brought within the proper distance of the work. Small currents can easily be used because the welding current alone is not depended upon to keep the arc alive.

The oscillator consists of a voltage transformer, spark gaps, condenser, and air-core choke coil connected as shown in Fig. 1. The voltage transformer charges the condenser and breaks down the spark gaps, and this discharge causes a high voltage high frequency oscillation between the condenser and the choke coil. The coil and condenser are adjusted to resonate at a frequency so high that the discharge has no physiological effect, and this removes the danger of shock to the operator. The frequency is also chosen so as to avoid radio interference.

Fig. 1 shows also the relation between the oscillator and the welding circuit. The requirements are that the welding current must not get into the auxiliary circuit, and that the high frequency discharge must take place at the electrode, and not

through the welding transformer. The connection shown fulfils these requirements, because a condenser passes high frequency currents with much less difficulty than low frequency currents, whereas a reactance is much more effective in resisting the passage of high frequency currents than of low frequency currents. Thus the low frequency welding current is effectively blocked from the oscillator circuit by the small condensers, but the high frequency oscillations can pass freely through these same condensers to the welding terminals. The

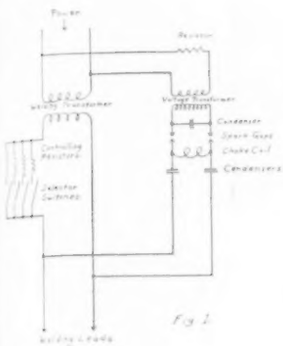


Fig. 1

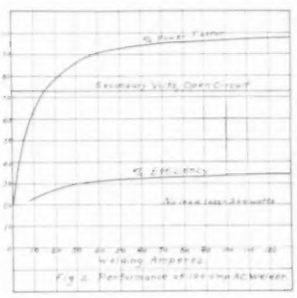


Fig. 2. Performance of Alternating Current Welder

high reactance of the secondary of the welding transformer, in turn, prevents the passage of the high frequency current and thus forces it to discharge across the arc path.

The welding transformer, the oscillator, and the resistors for controlling the welding current are mounted in a welded metal case. The case is provided with wheels and a handle so that it can easily be moved to the work. The controlling resistors are mounted behind an expanded metal screen and are separated from the rest of the outfit by a double metal

Welding with A. C. Equipment.

partition, so that their heat will not be transmitted to the rest of the outfit. Terminals for the primary leads are mounted at the back of the case, and terminals for the welding leads are located at the side of the case, just below four switches which control the welding current. The switches are enclosed in a guard so that only their handles are exposed.

The control switches serve to cut various resistors into the circuit in series with the welding leads. By combinations of the switches any desired welding current from 8½ amperes to 125 amperes can be obtained, in steps of about 8½ amperes. The use of resistance control for the welding current results in a high operating power factor, and the loss in the resistors is small. The electrical performance of the outfit is shown in Fig. 2.

In using the A. C. welder, certain differences will be noticed from D. C. welding. The D. C. arc is usually quiet, but the A. C. arc, especially if it is long, may have a distinct hum. The discharge across the spark gaps inside the case may also be audible. With an A. C. arc there is not so large a molten pool on the work as with a D. C. arc of the same amps., and the pool does not seem to boil so much. The welder who is familiar only with D. C. work may infer from this that the A. C. arc does not "burn in" sufficiently, but if he will make a few sample welds and break them he will be convinced, for the break never occurs between the deposited metal and the parent metal. The A. C. arc is almost entirely unaffected by magnetic conditions set up by the welding current.

When starting an A. C. arc, the current rises to full value almost instantly, and if the electrode is solidly touched to the work it often adheres. Consequently, a different method is necessary in starting. The superimposed high frequency usually will start the arc as soon as the electrode is brought within about 1/16 inch of the work, especially when the weld is hot. Starting a cold weld may require a light touch, but once the knack is learned no further difficulty is experienced. The penetration of an A. C. arc is somewhat less than that of a D. C. arc. This is really advantageous for thin work, such as welding sheets. For heavier work where more penetration is desired it can easily be obtained by increasing the current and using a larger electrode. Incidentally this results in a gain in speed.

To determine the strength of welds made by this system, a series of ten welds was made between ⅜ inch hot rolled steel plates. The welded part of the plates was then machined to a uniform size and tested to destruction in the testing machine. The tensile strength of the ten samples ran between 41,200 and 60,800 lbs. per sq. inch, with an average of 52,000 lbs. per sq. inch. Six of these samples broke at the weld and four in the plate about 1½ inches from the weld.

This new alternating current welding system is applicable for general welding service within its current range, and it also opens up a new field for welding because it enables thin plates and heavy sheet metal to be arc welded satisfactorily and economically. It can be used either with bare or coated electrodes. Fig. 3 shows its application to welding thin duct braces.

Schools Benefit by Following Trends

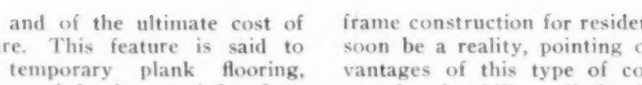
The training of oxy-acetylene welders in trade and industrial schools is being noticeably influenced by the trend toward more careful and systematic selection of operators by employers. Firms who are using the oxy-acetylene torch on many applications of major importance are appreciating the economic advantages of having welders properly qualified before starting them on the job. The better class of trade schools have seen the necessity for training students to meet these tests, which are fairly uniform in specific applications. There are some schools which have not been able to raise their instruction standards to meet the requirements of present conditions and have practically gone out of existence as a result. On the other hand, there have been some others more recently organized with the special purpose of training students to qualify. The number of privately-owned trade schools operating for a profit has not therefore changed materially, but the average standard of instruction has shown some improvement.—*From the I. A. A. Oxy-Acetylene Committee Report.*

Case School Will Have Conference on Metals and Alloys

In an endeavor to bring together executives and engineers for the consideration of certain phases of engineering progress, the Case School of Applied Science, Cleveland, Ohio, and the Cleveland Engineering Society last year started a series of educational conferences. These met with such success last year, three such conferences are planned to be held during the current school year. The first of these will be a conference on metals and alloys scheduled for November 18, 19 and 20. This has been planned to appeal to architects, structural engineers, power and process engineers, design and product engineers. For these men a complete program has been arranged including as speakers Dr. A. A. Bates of Case School of Applied Science; Dr. M. A. Grossman of the Republic Research Corporation; T. H. Wickenden of the International Nickel Company; W. R. Hibbard of the American Brass Company; W. M. Pierce of the New Jersey Zinc Company; L. W. Kempf of the Aluminum Company of America and Dr. John A. Gann of the Dow Chemical Company. In addition there will be a number of prominent speakers to discuss the application of various alloys in specific fields. There will be demonstrations and exhibits of apparatus and materials. The conference is open to anyone interested and a registration fee of $2.00 will be charged to defray the cost of the conference. Additional information may be secured by addressing F. L. Plummer of the Case School of Applied Science.

A New Type of Steel Flooring

A new type of steel plate flooring has recently been developed by the Belmont Iron Works, Philadelphia. The manufacturers point out that this floor can be detailed, fabricated and erected by the structural steel contractor at the same time as the primary steel frame, thereby effecting a saving in time of the completed job and of the ultimate cost of the stucture. This feature is said to eliminate temporary plank flooring, wood forms, reinforcing steel for floor slabs, and reinforcing mesh for floor slabs. It provides a rugged, safe, fireproof working floor for all building strains and the storage of all building materials as fast as the frame is erected.



Belmont Steel Flooring.

The flooring is constructed from solid, rolled structural shapes with fillets and sharp edges. The longitudinal ribs formed by the interlocking flanges of the sections used form a horizontal plate girder of great stiffness distributing the wind stresses uniformly to all building columns. This type of flooring can be shop fabricated in any length and in any number of units by means of bolting, riveting or welding, both in shop or field.

The manufacturers point out that this type of flooring besides being useful for multiple storage building is also suitable for the construction of heavy floor such as for loft buildings, warehouses, manufacturing floors and power house floors, supporting heavy machinery. The accompanying sketches show the construction principle and also indicates how the units may be united by any one of three assembly methods including welding.

Grand Rapids Welding Supply Co. Entertains Power Engineers

The Grand Rapids Welding Supply Company, Muskegon, Michigan, were hosts at a meeting of the National Society of Power Engineers held in Muskegon on the evening of October 26. Mr. Thomas Evans is president of the local group and E. M. Melso is vice-president and chairman of the educational committee. During the meeting above mentioned there was a showing of the motion picture entitled "The Magic Flame," which was produced by the Gas Products Association. Mr. Glen MacCauley, of the Grand Rapids Welding Supply Company, gave a lecture on the early history of welding and the construction and functions of welding equipment. A talk on up-to-date welding developments of interest to power engineers was given by L. C. Monroe of *The Welding Engineer*.

Structural Welding Discussed at St. Louis

On Friday evening, October 23, the St. Louis Welding Society held its monthly meeting at the plant of the Scullin Steel Company. Mr. H. Dreibus, mechanical engineer of the Scullin Company, described the new steel frame bungalow recently designed by that company. He predicted that steel frame construction for residences would soon be a reality, pointing out the advantages of this type of construction, namely, durability, elimination of fire hazard, elimination of vermin, safety in case of wind storms, etc. A film was shown which showed a residence recently constructed in Cleveland, the cost of which was equivalent to the cost of frame construction, and which involved great advantages not found in wooden buildings.

One of the objects of the St. Louis Welding Society is to get the building code of that city to approve the erection of welded construction of all kinds. The membership of the Society is increasing and the organization promises to become a real factor in the development of welding in that district.

Two Aspects of Arc Welding Considered at Chicago Meeting

Two papers of great importance to those using arc welding on a production basis were read at the meeting of the American Welding Society, Chicago Section, which was held in the Palmer House, Chicago, on the evening of November 6th. The first paper, entitled "The Economics of Quality Welding," was presented by Robert E. Kinkead, Consulting Engineer, Cleveland, Ohio. Mr. Kinkead defined quality welding as being welding of a satisfactory quality to suit the job in hand, and then proceeded to show that this did not mean a low standard. On the contrary, he asserted that 50 per cent of the production welding done in the country was of inferior quality. He pointed out the dangers to profits involved in not tracing losses back to the welding department and emphasized the necessity for finding the right way to do a job and always doing the job that way.

The second paper, entitled, "Welding Research with Special Reference to Fatigue Strength and Strain Relief," was presented by Chas. H. Jennings of the Research Department of the Westinghouse Electric and Mfg. Co., East Pittsburgh, Penn. This paper, illustrated by lantern slides, described a long series of fundamental experimental studies. Some of these are for the purpose of determining the effect of welding procedure, peening and annealing on the fatigue strength of weld metal. Others were for the purpose of determining the nature and extent of residual strains and methods of relieving these strains. The paper also included a study of various methods of preparation of test specimens for tensile tests, showing that the method of designing and preparing the specimen had a great deal to do with the determined result and that there was, therefore, some danger of getting misleading results in testing if the preparation of the pieces was not taken into account.

New Torch Lighter By Modern Engineering Co.

A new flint lighter has recently been developed by the Modern Engineering Company, St. Louis, Mo. The frame of this is a single piece of spring strip formed to provide a comfortable grip. A round file is used. The flint holder carries three flints, so that when one is worn, another is readily slipped into position. The lighter with three flints retails at 50c, and a renewal holder containing three flints sells for 25c. This has been given the name of the Tripl-Flint Lighter.

Correction

In the September issue of THE WELDING ENGINEER, announcement appeared of the opening of a new welding shop at Orange Street and Long Beach

Boulevard in North Long Beach, Calif. This should have been Compton, Calif., instead of North Long Beach. Our error is hereby acknowledged.

A 328-Ton Welded Vessel

An oil cracking unit, said to be the largest ever built, has just been completed for Mid-Continent by the A. O. Smith Corporation of Milwaukee. Designed to be assembled in the field, this huge unit consists of a horizontal reaction chamber or precipitator and a vertical fractionating tower.

The reaction chamber is 10 feet in inside diameter, 67 feet 7 inches in length and has a wall thickness of 3½ inches to 7½ inches. It weighs 404,000 lbs.

The tower is 8 feet in inside diameter, 72 feet 2 inches long and has 2¾ inches wall thickness, weighing 253,000 lbs. A section of the vessel is lined on the inside with a corrosion resisting alloy. The combined weight of the two vessels is 657,000 lbs.

The chamber and tower will be joined in the field by arc welding to form a single vessel in the form of an inverted "T". This joint, incidentally, is claimed to be the largest field weld on record, being about 25 feet in circumference and 2¾ inches thick.

This still will be operated at 400 pounds pressure in combination with 900° F. temperature. The raising of the vessel to this temperature, so high that the steel has a pronounced glow in the dark, naturally produces expansion and considerable movement. To compensate for such movements, engineers of the A. O. Smith Corporation have provided spring cushions at the ends and enormous bronze-clad supports at the center, where it carries the vertical tower, permitting a rocking motion by the big shell.

When completed, the unit will have a daily throughput of 5,000 lbs. of crude oil. The unit will be installed at the Mid-Continent Petroleum Corporation, Tulsa, Oklahoma, Refinery.

Los Angeles Section Holds Session on Metallurgy

The first fall meeting of the Los Angeles Section of the American Welding Society was held on the evening of Oct. 15th.

The first talk of the evening was given by J. Desario, Plant Metallurgist for the Torrance plant of the Columbia Steel Company. Mr. Desario's talk featured the metallurgy of steel. He described the processes used in the manufacture of steel together with the effects of different elements on steel, particularly in regard to their effect on the weldability of steel. Mr. Desario's talk was followed by a general discussion.

The second speaker of the evening was Mr. Edward Fess, Consulting Metallurgist, who gave an interesting talk on the Metallography of steel. Mr. Fess had some very interesting photomicrographs which he showed and explained.

J. I. Banash Re-Elected Vice President of the National Safety Council

On Wednesday, October 14, Mr. J. I. Banash, Consulting Engineer of the International Acetylene Association, was re-elected vice president of the National Safety Council. The Twentieth Annual Safety Congress was held at the Stevens Hotel, October 12th to 16th. This included a very interesting program of about 350 papers at some 125 sessions during the week. The exhibition of safety appliances in the exhibit hall was very interesting and well attended.

Trailer Plant Is All Welded

The new arc welded plant of May Trailers, Inc., at Morgan City, La., has just been completed. The construction consisted of concrete foundations and walls and steel framework and roof, all framework being welded. Welded steel windows of large proportions, allowing unusual ventilation, were employed.

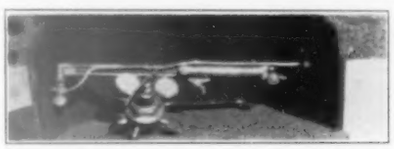
The company has its home office and plant at Shreveport, La. H. B. May is president and general manager. The Morgan City plant will be devoted to the manufacture of trailers largely for the sugar cane industry.

Waukegan Welders Enjoy Movie Program

On Friday evening, October 16, the Waukegan Welding club of Waukegan, Illinois, held a meeting at the Aviation Mechanics Building at the Great Lakes Naval Training Station. Mr. A. J. Beldon of the Linde Air Products Company had charge of the program which he opened with a lecture in which he explained the equipment and materials used in oxy-acetylene welding, the purpose of each part of equipment and the methods of handling which would insure the best operation and the lowest maintenance costs. This lecture was followed by several reels picturing the operation of welding and cutting torches and regulators, showing exactly how the flow of gases and the mixture of the gases is controlled and how the gases are adjusted to insure greatest efficiency in the flame. These pictures were followed by others showing welding operations in aircraft construction, pipe line construction and a wide variety of production in fabricating plates of all kinds.

Cutting Torch Helps Reclaim Sunken Treasure

Early in September of this year the ocean liner Columbia struck a hidden reef at point Tosco off the shore of Mexico with a big load of passengers and about $200,000 in gold, jewels and bullion. The Merritt, Chapman & Scott Salvage Company were called in to cut into the ship and get possession of the treasure from the purser's strong box.



Special under-water cutting torches were obtained from Roy Thomas, proprietor of The Torch Shop in Los Angeles and quickly dispatched to the scene of the wreck. The torch supplied by Mr. Thomas displaces water by means of compressed air bubbles so that the cutting flame has a chance to work on the metal. The accompanying photograph shows the appearance of this special under-water cutting torch. In this case it was required to perform 31 ft. below the water level.

Welded Steel at Less Cost Than Riveted Construction

Approximately 3500 tons of structural building steel have been fabricated by The Austin Company, engineers and builders of Cleveland, in the past year, according to an announcement by Harry E. Stitt, chief engineer. This tonnage includes ten contracts, and is by far the largest volume of welding in the company's experience. It represents nearly $3,000,000 in building construction.

All the steel was fabricated and welded in the Bliss Mill plant of The Austin Company, and shipped directly to the jobs where it was erected by field welding, riveting or bolting as conditions required. The largest shipment was for the new $1,000,000 wire filament plant of the General Electric Company in Cleveland, requiring more than 1000 tons of structural steel. To fill this contract, Austin engineers welded the largest steel trusses on record, each truss being 80 feet long. Field welding was used in erecting the steel for this job.

"Welded steel construction represents one of the most important contributions ever made to the building industry," said Mr. Stitt. "Research and experience have enabled us to offer welded steel at less cost than riveted construction of equal strength. In addition to lower cost, it is a stronger and more rigid construction and a faster and simpler method of erection. It also permits longer steel spans with fewer

component parts, effecting a reduction in tonnage required. Another advantage is that the finished structure represents a neater appearance. We believe that welded steel construction will soon be the generally accepted standard in industrial building practice."

A. A. Probeck Is New Sales Manager of Federal

Announcement has been received of the appointment of A. A. Probeck as sales manager of the Federal Machine and Welder Company, Warren, Ohio, manufacturers of resistance welders. Mr. Probeck started in the welding industry in 1910 with the C. & C. Company,

A. A. Probeck

one of the first manufacturers of electric arc welders. He joined the Federal Machine and Welder Company's organization in 1912 and in 1917 left that company to return to the arc welding field, where he remained until October 1, at which time he returned to Federal.

Australians Have Meeting on Welding Problems

The regular September meeting of the Australian Welding Institute, which was held at Melbourne on Thursday, September 17, was devoted entirely to a discussion of a series of problems as follows: 1. What would be the correct procedure in welding manganese steel where strength is required? 2. Is it possible to weld non-deoxidized copper sheets? If so, what is the proper method? 3. Are two runs satisfactory in lap welds? 4. What is the correct method of welding the chassis of a heavy-duty motor truck? These questions were submitted for general discussion at the meeting and every member was requested to make every effort to attend and to participate in the discussion. It would seem to be a good thing for welding associations to hold meetings on this plan occasionally so as to keep members reminded of the practical value of association work.

California Welding Shop Owner Erects New Plant

Al Joslin, who for a number of years has operated a welding shop on West Manchester Avenue in Los Angeles, has recently been carrying out an extensive expansion program in his shop and business.

A new building, 50 feet wide by 60 feet long has been erected just recently on the lot adjoining his old location. The new building will fill a long-felt need by providing sufficient space for additional equipment and added facilities for a

New Home of Al's Welding and Iron Works.

more diversified line of work. Mr. Joslin has just finished moving into his new quarters, the address of which is 1047 West Manchester Avenue.

The photograph shows the new building and Mr. Joslin in front of his new establishment. The new shop will bear the name of Al's Welding & Iron Works. General welding and repair work of all kinds will be handled in addition to which will also be featured ornamental and general wrought iron work.

Plans are being completed for the early installation of a large gas furnace for preheating purposes, etc., which in addition to a large crane for handling heavy machinery and equipment and other modern shop equipment, will make the plant one of the most up-to-date shops of its kind in the city. As a part of his equipment, Mr. Joslin has just completed the construction of a portable electric welder which includes a 200-amp. General Electric generator.

Welding Conference at Minneapolis

A two-day conference on welding processes is being planned under the auspices of the North West Chapter of the American Society for Steel Treating, and the Manufacturers' Association of Minneapolis, Inc. The Conference will be held at the plant of the Caterpillar Tractor Co., 2601 University Ave., S. E., Minneapolis, starting at 7:00 P .M., November 19, and closing November 21 at 5:00 P. M.

The lectures and discussions will cover up-to-date developments in both gas and electric welding and it is planned to provide for exhibits of apparatus and materials.

New Oil Tanker Is All Welded

The Atlantic Refining Company report the recent completion of their new motor tanker "White Flash," which was built by the Sun Shipbuilding & Dry Dock Company, Chester, Pa., and launched a short time ago. The notable feature of the new tanker is that she is of all welded construction, entirely eliminating the use of rivets. This form of construction not only means a much stronger ship from the point of view of seaworthiness, but also there can be no question of corrosion around rivets, one of the chief worries of the tanker operator. All-welded construction materially simplifies scaling and cleaning, and this job is expected to set a standard by which future tankers will be gauged. The new vessel is 201 feet long, and is expected to go into service in the near future.

Safety Pamphlet on Pressure Vessels

Safe Practices Pamphlet No. 60, published by the National Safety Council, is devoted to the subject of pressure vessels. In this pamphlet attention is called to existing codes on pressure vessel construction with particular reference to the safety appliances which are dictated by the codes. There is also a summary of those provisions in codes which make for safe construction including suggestions for proper supports in foundations. Another section of the pamphlet is devoted to the operation of pressure vessels, including inspection, maintenance and care of compressors. The bulletin concludes with discussions of lessons learned from accidents to pressure vessels.

Hard Surfacing in Road Making and Excavating

The latest issue of Fusion Facts, published by the Stoody Company, Whittier, Calif., comprises a series of well illustrated articles showing the wide application of hard surfacing materials to road making and for excavating equipment. Illustrations show the uses of these materials in drag-line buckets, dredges, ditching machines, scarifier teeth, dipping machines, road graders, power-shovel teeth, runners and road milling cutters. The cost of applying hard surfacing materials is summarized in tables which indicate the cost factors separately for electric and gas welding and are so arranged that the user can make up his cost estimate on the basis of his own costs for materials and labor.

Folder Describes Secator Cutting Machine

Jos. C. Paulus & Company, Philadelphia, Pa., have prepared a four page folder describing and illustrating the "Secator" motor driven hand-cutting machine. A feature of this machine is the tachometer which registers cutting velocities of the machine at any time in inches per minute. The machine is driven by a universal motor and has two kinds of cutting heads, one using the interior of the cutting nozzle in the center of the head nozzle which screws into a round head. The other has a cutting nozzle behind the head nozzle fitted into a flat head. The latter is recommended for cutting metal up to ½" thickness but above this thickness the

former type of cutting head is recommended. The capacity of the machine is from ⅜" to 4" in thickness. Irregular curves are cut by hand without a template. Straight cuts are made by using a length of 1½" angle iron for a guide and circular cuts from a radius of 3" up to any diameter are made by means of a trammel supplied with the machine. Bevel cuts may be made by a simple adjustment of the cutting tip, this adjustment being possible in both directions. It is stated that the operation of this machine is so simple that an untrained workman can produce clean cuts by following the working chart.

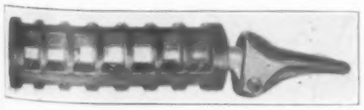
New Tool Announced for Pipe Line Welders

A new welding tong designed especially for turning pipe in either direction on welding jobs has been announced by its manufacturers, The Gearench Manufacturing Co., of 313 Hughes Street, Houston, Texas. The new tong which will be known as the "Petol Welding Tong," is light, strong, chain and friction type and has no teeth. Without being removed from the pipe it turns the pipe toward or away from the operator. In either direction the grip is instant and positive, and release is also quick and positive. The tong cannot bind or "freeze" on the pipe so as to rotate it when being released. The tong ratchets freely in either direction.

The weight of the tong is carried on the pipe, making operation easy. Tongs are furnished with long handles for leverage and convenience. Jaws are made in one piece, eliminating spreading. Each size of jaw fits several sizes of pipe. The jaws are made in sizes to fit pipe from 6-in. to 26-in. and all jaws are interchangeable by removal of one bolt. Construction is of nickel chrome steel throughout. Heavy, special heat-treated chains are furnished. The chain is easy to hook and unhook, chain hooking slots being integral with the jaws. These welding tongs are furnished in three handle lengths, according to the size of pipe to be turned. Jaws are furnished in 12 sizes from 4-inch to 26-inch.

Steel Sales Announces New Electrode Holder

Steel Sales Corporation, Chicago, has recently been appointed exclusive distributor for the Suregrip Electrode Holder, the construction of which is shown in the accompanying illustration. One feature of this is the ventilated handle and another is the method of

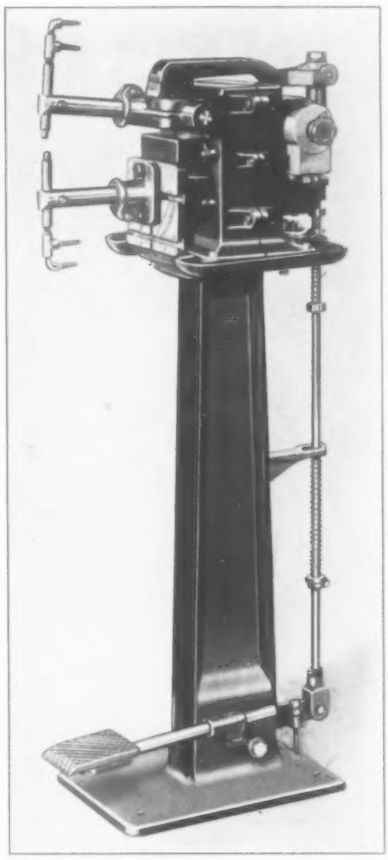


Suregrip Electrode Holder.

gripping the electrode. The moveable part of the twist grip is controlled by twisting the handle which pushes the vise jaws together. The weight of the holder is approximately 15½ oz. The wire vise is replaced without removing the cable from the handle, and the holder does not contain a spring of any kind. The length of the holder is adjustable from 8½" to 12" and it can be used for any size of wire.

Eisler Electric Speed Spot Welding Machines

The Eisler Electric Corporation of 740-772 South Thirteenth St., Newark, N. J., have expanded their line of speed spot welders which they have been manufacturing for the past twelve years. The range now covers ½ to 25 K.V.A.

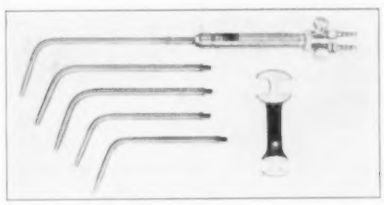


One of the New Eisler Speed Spot Welders.

with machines of the following capacities: ½, 1, 3, 5, 10, 20 and 35 K.V.A. capable of handling from .0005" to ⅝" combined thickness of steel. Speed welding machines are extensively employed in the manufacture of radio tubes, incandescent lamps, jewelry, metal novelties, sheet metal work, dental, automotive and electrical appliances also used in many other manufacturing industries. The principal advantages of speed welders are speed in production, uniform welds, positive and smooth action, simplicity of construction, few working parts, wide range of heating steps and low maintenance cost.

Airco-D-B Style 9800 Welding Torch

The Air Reduction Sales Co. has recently placed on the market a new welding torch known as Style 9800. This new torch is well-balanced, of strong, sturdy construction, designed for the medium and heavy classes of oxy-acetylene welding. Important new features of this torch are as follows: ribbed handle, new type mixing head nut, oxygen and acetylene ball seat type needle valves, needle valves easily repacked and soft flame characteristic. The ribbed handle affords a positive gripping surface without harshness to the hand. The use of a wrench to properly position the tip each time one is changed has been eliminated through the design of the new mixing head nut. A skirt has been added to the hexagonal nut, allowing it to be loosened or tightened by hand. If for any reason the mixing head nut cannot be loosened by hand, a wrench can be applied to the hexagonal nut. The new style ball seat type needle valve has been adopted for this torch after extensive field trials which indicated that it would perform to satisfaction even after having been



Airco-D-B 9800 Torch.

in service for a long time with plenty of operation. The principal feature is a ball seat of stainless steel, strong, hard, and durable. Repacking, if necessary, can be accomplished easily, using Palmetto wick packing, usually available in nearly all shops and plants. The needle valve handles are ribbed to match the torch handle, and afford a good grip.

The soft flame characteristic is achieved in the Style 9800 torch by reversing the conventional method of bringing the gases to the tip. In this torch the oxygen enters the torch head at the side and the acetylene through the center. The mixing device operates on the well-known principle employed in Airco-Davis-Bournonville torches, and assures intimate mixing of the oxygen and acetylene before entering the tip.

The Style 9800 torch is adaptable in that it meets not only a wide range of requirements for welding, but with the cutting attachment furnished, it can be made to serve as an efficient cutting torch, serving acceptably for the range usually required by the welder. Tips of pure hard-drawn copper, of either the swaged or the separable type, can be furnished. Both types of tips are made to furnish either the bulbous or the long, pointed flame.

New Welding Wire by Champion Rivet Company

Announcement has been received from The Champion Rivet Company of Cleveland, Ohio, regarding the manufacture of a new line of gas and electric welding wire to be marketed under the trade name of Champion. The line of elec-

trodes includes a bright bare rod for general welding of mild steel, a processed rod for mild steel welding, a light coated rod for overhead welding, a mild coated rod for welding requiring 55,000 lbs. tensile strength, and a heavy flux coated rod for high tensile strength and ductility. The Company announces that it has secured the services of competent engineers and has established physical and chemical laboratories for the control of the quality and uniformity of the product. The welding wire will be furnished packed in cylindrical fiber containers with metal ends securely fastened and marked plainly for easy identification.

New Cutting Tip for Propane Gas

Roy Thomas, proprietor of The Torch Shop, Los Angeles, Calif., and designer of several types of torches, has recently designed a new torch tip for use with propane gas as a fuel for cutting. Mr. Thomas states that with this new tip the propane gas is broken down so that a 50-50 ratio of hydrogen and carbon is obtained in the pre-heating cone, the balance of the hydrogen being consumed in the envelope of the flame. This is said to facilitate the rapid starting of the cut and to keep the oxygen consumption at a minimum.

Lincoln Electric Company To Distribute Blackor

The Lincoln Electric Company, Cleveland, Ohio, has been appointed general industrial distributor for Blackor, an abrasion-resistant facing. Blackor is a black granular material of high grade tungsten carbide. Applied with a carbon arc, Blackor covers the entire abrasion surface of a tool.

Blackor is said by the manufacturers to have the following interesting characteristics: It maintains its abrasion-

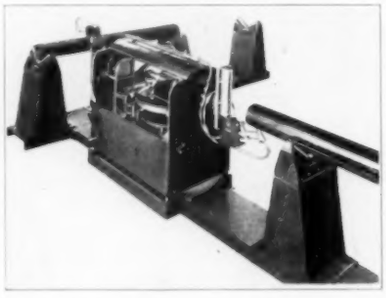
Applying Blackor with the Carbon Arc.

resisting quality at red heat. It is so fused with the arc that it will bend with the parent metal without flaking off. A Blackor facing becomes harder toward the nitride and is in performance like case-hardened steel. It has a scratch hardness of 9 plus and will scratch a ruby. This material is used in many applications including fishtail, disc and diamond drills, shovel teeth, grinding shafts, and so forth. Procedure varies slightly with each application, but is in general as follows:

1. Surface must be ground clean, and if any other hard facing material is present it should be "washed" off with a carbon arc.
2. The surface should be prepared with a layer of weld metal deposited with a high carbon electrode.
3. Blackor granules are then spread over the surface and fused into the metal with a carbon arc. The illustration shows the application to an airplane skid shoe, typical of its industrial application. One layer is, in most cases, sufficient. One ounce will cover 3 to 4 square inches.

New Machine for Cutting Pipe to Be Welded

The Douglass Pipe Fitting Machine is a device which automatically prepares pipe of 2" to 18" diameter for fabrication into welded tees, mitered elbows and plugs. It also bevels plain end pipe for butt welds. The mechanical movement of the cutting torch is a combined rotating, longitudinal and angular motion which produces in one operation cuts of the correct shape and proper bevel. No templates or patterns are



Douglass Pipe Fitting Machine.

needed as the required template for any cut is generated in the machine itself by making two simple adjustments. The pipe standards are of fixed height and the cutting machine is quickly raised or lowered to suit the size of pipe cut.

This machine was developed by practical pipe fitting contractors for the purpose of reducing the cost of preparing pipe for welding, and further to reduce the cost of the welding operation by providing parts accurately cut. The pipe comes from the machine with the cuts clean, free from scale and oxide and ready for welding. It is claimed that the precise adjustment of the cutting speeds prevents warping and distortion in the pipe. All parts are amply strong for the purpose they perform. The pipe standards are of heavy welded steel plate with cast steel heads and a rigid base of the whole machine is of 18" channels. The machine is being marketed by H. A. Brassert & Co., 310 S. Michigan Ave., Chicago.

124 Miles of 26-Inch Pipe Is Arc Welded

H. C. Price, Inc., of Bartlesville, Oklahoma, announce that they have completed the electric welding of 124 miles of 26-inch line for the Southern Fuel Company of California. The total length of this line is approximately 200 miles, each joint of which is welded. This is thought to be the largest, solid welded, large diameter gas line that has been completed to date. The electric welded section was completed eighteen days ahead of schedule.

For Insulated Cooling And Heat Treating

Joseph Dixon Crucible Co., Jersey City, N. J., manufacturers of graphite products, have placed on the market Dixon's H-30 Granules, a clay-graphitic composition for use in insulated cooling of welded materials and in heat treating. Dixon's H-30 Granules, which are semi-insulating and conduct heat at a slow, uniform rate are employed for use in cooling in preference to such materials as sand or ground silicon and carbonaceous, semi-insulating materials such as a mix of charcoal and ashes. In special cases H-30 granules are mixed with sand to secure any desired rate of cooling. H-30 granules are available in 25, 100 and 400 pound lots.

David H. Smith & Sons Announce Sales Appointments

David H. Smith & Sons, Inc., Brooklyn, N. Y., manufacturers of the Smith-Waters Welder, have appointed as sales manager of the welder department, W. H. Wilson, who has been connected with the Smith organization in various capacities for the past nine years.

Mr. Charles Featherstone, who for twelve years was associated with the Waters Arc Welder organization, and who in his sixteen years in the industry has developed a number of applications of arc welding, has been appointed Sales Engineer for Smith-Waters welders.

Southern Oxygen Company To Handle Harris Line

Announcement has been received of the appointment of the Southern Oxygen Company, Washington, D. C., as distributors of the complete line of oxy-acetylene welding and cutting equipment manufactured by the Harris Calorific Co., of Cleveland, Ohio. The territory covered will include District of Columbia, Virginia, West Virginia, Maryland, and the southern part of Pennsylvania. The Southern Oxygen Co. are manufacturers of oxygen for industrial and industrial use, compressed acetylene, and distributors of carbide and welding and cutting apparatus and supplies. Warehouse stocks have been established in about thirty cities in the territory covered.

A: Close-up of flywheel after repair-welding with Tobin Bronze.

B: The bronze-welding flywheel restored to service on the punch press, as strong as before the fracture occurred.

C: Welder repairing broken flywheel by the oxy-acetylene method with Tobin Bronze.

ANACONDA
from mine to consumer

There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze*	1625° F
Manganese Bronze	1598° F
Brazing Metal	1634° F
Naval Bronze	1625° F
Electrolytic Copper	1981° F
Silicon Copper	1981° F
Phosphor Bronze	1922° F
Everdur*	1866° F

for arc welding

Silicon Copper	1981° F
Phosphor Bronze	1922° F
Everdur*	1866° F

*Reg. U. S. Pat. Off.

Repair-Welded with TOBIN BRONZE

. . . *in six hours!*

No time is lost in repair-welding castings with Tobin Bronze. When this 2800-lb. flywheel fell from a punch press and cracked, a welder using Tobin Bronze Welding Rods needed *only six hours* to put it back in service . . . as strong as ever!

Tobin Bronze saves time . . . and money . . . because the low welding temperature required usually eliminates pre-heating. Complete information contained in Publication B-13.

* * * * * *

Anaconda Welding Rods are available through leading distributors of welding equipment and supplies. For those requiring small quantities, Anaconda Welding Rods can now be obtained in clearly labeled ten-pound packages.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in all Principal Cities

ANACONDA WELDING RODS

When **EYES** *are put on the spot*

A BULLET proof vest that covers only from neck to waist isn't sufficient protection for the man who is put on the spot.

Nor are lenses that merely cut down glare and screen out some of the injurious ultra-violet rays sufficient protection for eyes that are put on the welding spot. Eyes that work at welding need full protection from ultra-violet and eye-burning infra-red rays, as well as glare.

Noviweld lenses offer the most complete protection yet devised. Noviweld cuts down the glare but allows greater visual detail, it cuts out all the ultra-violet and all but ½ of 1 per cent of the infra-red!

It's good business to provide your welders with patented Noviweld lenses in A O Duraweld goggles. They work faster and more accurately because they can see better and have assurance of complete protection from injurious light and flying particles.

NOVIWELD *lenses*

T. M. Reg. U. S. Pat. Off.

J316

AMERICAN OPTICAL COMPANY
SOUTHBRIDGE, MASSACHUSETTS
SAFETY DIVISION
BRANCHES IN PRINCIPAL INDUSTRIAL CENTERS

News of the Industry

M. C. Morris has been appointed sales manager for the Hall & Lowery Iron Works, Inc., of Goose Creek, Texas. This company manufactures inside oil well casing cutters, automatic casing spears, and Stafix pumps, as well as maintaining a well equipped welding department for field service. Mr. Morris was formerly with the International Derrick & Equipment Company.

A contract which will furnish work for a large number of welders will soon be awarded by the Texas Company for the construction of a gasoline plant in the Kettleman Hills oil field of California, which will replace the company's plant which was destroyed by fire in September. The new plant will have a daily capacity of 80,000 gallons. Welding is employed extensively in the construction of these plants.

The Furlong Boiler Works, 400-408 East Court Avenue, Des Moines, Iowa, oxyacetylene welding, in business for more than 47 years, issued a bright report on business conditions, reporting a 20 per cent sales increase for 1931, as agaist figures for 1930.

The Murray Body Works, Davenport, Iowa, including a complete welding service, has moved to a new and enlarged location at 413-15 Church Street. The firm, until recently at 533 Church Street, features every service complete under one roof.

Heim Machine & Engine Works, Oklahoma City, Okla., has opened a welding and machine shop at 4213 South Robinson Street to specialize in heavy engine welding and general machine work. C. E. Heim is owner and manager.

Barksdale Field, Shreveport, La., new home of the Third Attack Group, U. S. Army, Aviation Section, is installing a complete welding department in the assembly shop recently contracted for at that field, according to Capt. Geo. E. Lamb, Constructing Quartermaster in charge.

Lincoln Tank Co. has moved its main office and plant from Electra, Tex., to Shreveport, La., where it has completed a shop building, 108x230 feet, for fabrication of oil field tanks. The company has enjoyed a thriving business in manufacture of tanks for the East Texas oil fields and moved its plant to Shreveport to be nearer that area. F. S. Doores is general manager.

Sinclair Refining Co. is including a welding and machine shop in its rebuilding plans of the old Pierce Petroleum Corp. oil refinery at Fort Worth, Tex. J. N. Youmans is construction engineer in charge. Chas. Brown, master welder and machinist at the Sand Springs, Okla., plant has been looking after construction of the shop buildings and installation of equipment.

The Seattle branch of Hemphill-Diesel Engineering Schools was the scene of an unusual demonstration recently when the Seattle Oxygen Company of Seattle Wash., made specimen welds in aluminum, brass, cast iron and steel, using a new type of welding gas which they are now producing.

E. N. Stevens, who has been connected with the Harris Calorific Co., Cleveland, Ohio, in the capacity of assistant sales manager, has been seriously ill for several weeks in a hospital in Chicago. "Steve" has a host of friends in the oxy-acetylene industry who will be glad to know that he has recovered sufficiently to move to Florida where he will spend the next several months regaining his health. He states that if any of his friends desire to reach him by mail, he can be addressed at Lutz, Florida.

The Standard Specification of the Welder *and* Cutter

The name "Commercial" has been associated with dissolved acetylene since the beginning of oxy-acetylene welding.

"Commercial" is known for its RELIABILITY, UNIFORMITY, PURITY, and its ORGANIZATION for service to the industry.

Whatever your gas requirements, you should know about our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30 in. size—125 cu. ft. cap.
12x36 in. size—225 cu. ft. cap.
12x44 in. size—275 cu. ft. cap.

Commercial Acetylene Supply Co., Inc.

General office: 40 Rector St.
NEW YORK CITY

Branches:
600 W. Jackson Blvd., Chicago, Ill.
683 Atlantic Ave., Boston, Mass.
680 Hamilton Ave., S. E. Atlanta, Ga.

We also sell
OXYGEN
and a complete line of
APPARATUS
and
SUPPLIES

TRADE COMMERCIAL MARK ACETYLENE

THESE HOLDERS are now standard equipment with many concerns.

EUREKA Metallic Electrode Holder
GREAT STRENGTH, LIGHT WEIGHT, AMPLE CURRENT CAPACITY. NO SPRINGS
WELDING HELMETS
and
HAND SHIELDS
OF CORRECT DESIGN

VULCAN Carbon Electrode Holder With *and* Without WATER COOLING

Pioneers, Designers and Manufacturers
THE FIBRE-METAL PRODUCTS CO.
Chester, Penna.
DISTRIBUTORS WANTED

At a meeting of the Society of Automotive Engineers held in Detroit, October 7th and 8th, J. W. Meadowcroft, Assistant Works Manager of Edward G. Budd Mfg. Co., read an interesting paper on "The Advantages of Resistance Welding in the Manufacture of Automobile Bodies and Parts."

The Keller Mechanical Engineering Corp., Brooklyn, N. Y., was recently purchased by the Pratt & Whitney Company of Hartford, Conn., according to a recent announcement. Plans have been made to move the machinery and equipment to Hartford during the current month so that operations can be resumed the first of December.

Careful preliminary tests on methods of stress relief made possible the use of a large amount of welding to good advantage in the construction of gates for use in the pressure tunnels at ——— Dam in Tennessee, according to a recent article in the Engineering-News Record.

The Welding Engineering Company, 2872 N. 41st St., Milwaukee, Wis., has recently been appointed Wisconsin representative for Lukenweld, Inc., Coatesville, Pa., fabricators of arc welded steel.

Announcement was recently made of the organization of the Memphis Oxy-Acetylene Company, Memphis, Tenn., a $100,000.00 corporation, which will operate as a supply business for the Memphis territory.

It is reported that the part of the plant of the Williams Machine & Welding Works, Thomasville, Ga., which was recently destroyed by fire, is to be rebuilt.

Bennett S. Chapple, Jr., has been appointed Manager-Director of the Armco Distributors Association. Mr. Chapple has been with the American Rolling Mill Company since 1928.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of The Welding Engineer, published monthly at Chicago, Illinois, for October 1, 1931.

State of Illinois, County of Cook, ss.

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared H. S. Card, who, having been duly sworn according to law, deposes and says that he is the Editor of The Welding Engineer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, G. H. Mackenzie, Chicago, Illinois; Editor, H. S. Card, Chicago, Illinois; Managing Editor, H. S. Card, Chicago, Illinois; Business Manager, H. S. Card, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) The Welding Engineer Publishing Co., 608 S. Dearborn St., Chicago, Ill.; G. H. Mackenzie, 7321 So. Shore Drive, Chicago, Ill.; H. S. Card, 9709 Vanderpoel Ave., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

H. S. Card, Editor.

Sworn to and subscribed before me this 30th day of September, 1931.

(Seal.) G. W. Tyler.

(My commission expires June 25, 1932.)

A reorganization of the Galigher Company, Salt Lake City, Utah, distributors of welding equipment and supplies, places John T. Potts, General Sales Manager of the Hewitt Gutta Percha Rubber Corporation, Buffalo, N. Y., in the president's chair. It is reported that Mr. Potts will move to Salt Lake City to take over the active management of the Galigher Company.

In a paper prepared for the 1931 Proceedings of the Master Boiler Makers Association, J. C. Lincoln, Chairman of the Board of the Lincoln Electric Company, gives a personal history of his association with the development of the arc welding process.

The Chicago Bridge & Iron Works, Chicago, Ill., has under construction two Horton spheroids at Long View, Texas. These are being built for the East Texas Refining Company, and have a capacity of 80,000 barrels each. One of these huge all-welded containers is practically complete and the construction of the second one is well under way.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

Wanted to Buy—500 oxygen cylinders and 500 hydrogen cylinders of 220 cubic foot capacity. Address Box 442, The Welding Engineer.

POSITIONS WANTED

WELDING ENGINEER—College graduate, 18 years experience in steel fabrication, last 6 years devoted exclusively to the application of electric welding, competent to handle any branch of the program of applying electric welding to the design, fabrication and erection of structural steel and ornamental iron. Paul B. Covey, 564 North River Road, Manchester, N. H.

ACETYLENE INSTRUMENT MAKER:
Will design and perfect special submarine or natural gas cutting torches—or any other special equipment for oxy-acetylene welding or cutting.
The Torch Shop, 1637 E. Vernon St., Los Angeles, Calif.

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